# THE RELATIONSHIP BETWEEN MATURE KANSANS' FOOD SAFETY KNOWLEDGE AND THEIR CONCERNS WHILE EATING AWAY FROM HOME

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# Abstract

Foodborne illness is a serious health problem in the United States, and especially in the mature adult population. This research examined food safety knowledge of mature Kansans (aged 55years and older) in three important constructs (*handwashing, food handling, and food preparation*), their knowledge of foodborne illness symptoms, and their food safety concerns while eating away from home. One-hundred and forty participants completed a self-administered questionnaire containing ten food safety knowledge questions representing sixty answer options. Replies to those questions were compared by age, gender, geographic location, and educational attainment. Results indicated that geographic location was statistically significantly related to food safety knowledge; however, age, gender, and education had little to moderate association. Additional findings revealed food safety knowledge was not associated with participants' level of food safety concern while eating away from home. In conclusion, the findings revealed that mature Kansans possessed general food safety knowledge; however, some responses indicated mature adults did not fully understand certain food safety protocols. Areas identified as needing further attention included appropriate hand drying and surface cleaning, safe food and refrigerator temperatures, proper thawing practices, as well as safe leftover and melon preparation.

# Table of Contents

# List of Tables

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# CHAPTER 1 - Introduction, Literature Review, and Research Questions

## Introduction

Illness associated with improperly handled food presents a significant health problem in the United States (U.S.) today. The Centers for Disease Control and Prevention (CDC) estimate that foodborne illness affects 76 million Americans every year, with 325,000 hospitalizations and 5,000 deaths attributed to foodborne illness annually[1]. This estimate includes foodborne illness of known and unknown etiologies, as well as estimates of unreported cases[1]. The true incidence of foodborne illness is difficult to determine due to unreported cases. The economic impact is also extensive, with cost estimates in the billions of dollars[2]. The expenses associated with foodborne illnesses are difficult to calculate, and the actual costs for medical treatment, loss of productivity, and loss of life must be considered. In 2000, the United States Department of Agriculture's Economic Research Service estimated costs associated with only five microorganisms at $6.9 billion, and included the cost of treatment, loss of productivity, and premature death[2]. While only estimates are reported, the actual cost of foodborne illness is likely immense.

Some populations are at an increased risk for acquiring foodborne illness—the young, the old, and those with compromised immune systems. For various reasons, mature adults are at higher risk than other age groups. Several characteristics of mature adults contribute to their increased susceptibility: (1) changes in the body due to aging, including immunological changes; (2) declining health due to the presence of chronic illnesses (e.g., cardiovascular disease, cancer, *et cetera*); (3) adverse side effects of medications; and (4) incomplete knowledge of current food safety recommendations [3-5]. As the mature adult population continues to increase in the U.S., this problem will likely worsen. Currently, mature adults make up a significant portion of the American population. In 2008, almost 73 million Americans—approximately 24% of the U.S. population—were 55 years or older[6]. By 2050, 31% of Americans will be 55 years or older[7].

Mature adults are spending more money at restaurants, and their spending increased by 33% between 2000 and 2004[8]. Restaurants contribute to the incidence of foodborne illness; this is noteworthy since mature adults are at greater risk for foodborne illness and they are frequenting restaurants more often[9, 10]. According to the CDC, 59% of reported foodborne illnesses were associated with commercial operations[10]. Jones and Angulo from the Tennessee Department of Health and the CDC published similar results; commercial operations accounted for 52% of foodborne illnesses[9]. Few researchers have investigated the concerns of consumers regarding commercial food safety ("commercial food safety" refers to restaurant food safety). Virtually no literature addresses the commercial food safety concerns of mature adults. The next section features a review of literature pertaining directly and indirectly to mature adults and food safety.

## Review of the Literature Regarding Food Safety, Mature Adults, and Foods Consumed Away From Home

Food safety guidelines are generally accepted as principles that govern food handling, cooking, storage, and sanitation throughout the movement of food from harvest to consumption. Producers, processors, manufacturers, delivery services, grocers, restaurants, and those who prepare food in the home are all responsible for maintaining the safety of America's food supply. Food safety concepts have been studied for years; however, a majority of the research addresses the commercial food industry—restaurants, food manufacturers, and food processors[11]. In the early 1990s food safety experts realized very little information was known about consumers' food safety attitudes, knowledge, and behaviors; therefore, efforts have been made to fill this void[11].

### *Commercial Food Safety*

In response to growing food safety concerns, the Food and Drug Administration (FDA) created the National Retail Food Team in 1996 to explore the trends of foodborne illness, a significant public health problem in the U.S.[12]. In 1998, the team began a nationwide effort to investigate the practices of foodservice workers and report their compliance to the Food Code. The FDA publishes the Food Code every four years, and provides commercial operations with science-based guidelines to ensure food is handled properly[13, 14]. The FDA's Regional Retail

Food Specialists (subsequently referred to as specialists) observed institutional foodservice operations, restaurants, and retail food stores. Specialists categorized their observations into five risk categories identified as being most likely to cause foodborne illness. The following table will describe the risk categories and give examples of specific items specialists observed during their site visits.

**Table 1. Foodborne Illness Risk Categories as Defined by FDA**

| Risk Categories | Concepts Addressed | Examples |
|---|---|---|
| Food Holding | - cooling of hot foods<br>- dating of foods<br>- maintaining food holding temperatures | - cooling hot foods according to the Food Code's two-step process<br>- dating foods prepared on site within 24 hours of production<br>- maintaining cold foods at below 41° F |
| Personal Hygiene | - employee handwashing<br>- behaviors in food preparation areas<br>- handwashing stations<br>- handwashing supplies<br>- disposable glove usage | - washing hands at appropriate times<br>- drinking, eating, or smoking in selected areas only<br>- monitoring the location and supplies of handwashing stations |
| Sanitation/Contamination | - separation of food types<br>- protection of foods<br>- contamination of food contact surfaces | - separating raw meats from ready-to-eat foods<br>- protecting foods from dust, chemicals, and other foods<br>- monitoring cleanliness and sanitation of counters, equipment, and utensils |
| Food Cooking | - cooking temperatures of foods<br>- reheating of foods | - cooking poultry to 165° F for 15 seconds<br>- reheating foods to 165° F for 15 seconds rapidly |
| Food Procurement | - sources of food<br>- condition of food upon arrival to the facility<br>- food documentation | - acquiring food from Regulated Food Processing Plant<br>- receiving food at proper temperatures<br>- saving shellstock tags for 90 days after food is consumed |

Food and Drug Administration National Retail Food Team. FDA Report on the Occurrence of Foodborne Illness Risk Factors in Selected Institutional Foodservice, Restaurant, and Retail Food Store Facility Types. 2004.

The initial report published in 2000 established a baseline measurement for those five risk categories. The specialists' observations evaluated almost 4,000 practices in 2003 with findings published in 2004. This section of the literature review will cover the specialists' findings from the 2004 report; in addition, summarize the improvements observed since the first report[12].

***Fast Food Commercial Operations***

Overall, fast food restaurants practiced safer food handling practices than did full service operations[12]. A majority of the fast food industries' food safety errors were detected in three of the five risk categories—food holding, personal hygiene, and sanitation/contamination. Specialists regarded compliance as acceptable in food cooking and food procurement. Specialists observed the greatest number of errors in the food holding risk category; nearly 42% of the total observations did not comply with Food Code recommendations[12]. Specific errors included inadequate food dating and improper temperature holding. Approximately half of the 125 observations monitoring food dating revealed foods were not dated according to Food Code standards or lacked dating entirely. Maintaining proper hot or cold food holding temperatures is vital for food safety; yet, 45% of 202 observations did not comply with current standards. For microbial reasons, the Food Code requires hot foods to be held above 140º F and cold foods be held below 41º F[12, 13].

Specialists also observed errors in the risk category of personal hygiene, which is essential to serving safe food[12]. Nearly one-third of the total personal hygiene observations were unacceptable with inadequate handwashing as the most common risk error noted. Hands were either not properly washed or handwashing did not occur at appropriate times during food preparation[12]. Improper handwashing is a major contributor to foodborne illness; hands can easily transfer harmful organisms to food[15]. Another personal hygiene violation, was improper disposable glove usage while handling ready-to-eat foods (foods that will not go through a cooking process before consumption), as well as eating, drinking, or smoking in food preparation areas[12].

Sanitation/contamination, which addresses the cleanliness of the facility and the instances of cross-contamination included errors in about 20% of the observations[12]. Cleaning and sanitizing of surfaces and utensils and separating raw foods (foods that must be cooked before consumption including eggs, beef, pork, poultry, fish, and other seafood) from ready-to-eat foods

(that can be consumed without cooking ) are important in preventing foodborne illness. Over 50% of the observed facilities did not clean or sanitize equipment or surfaces properly[12].

Additionally, fast food restaurants did not correctly store raw foods and ready-to-eat foods. Ready-to-eat foods should be stored above raw foods, and raw foods should be arranged according to the end-point cooking temperature. Fish or whole roasts have the lowest end-point cooking temperatures, and should be stored below ready-to-eat foods and above hamburger or chicken, which have higher end-point cooking temperatures[13].

***Full Service Commercial Operations***

Full service restaurants did not perform as well as their fast food counterparts; specialists observed more troubling practices during the observations[12]. The risk factor with the greatest out of compliance rating was food holding with nearly 65% of the observations unacceptable. Full service restaurants did not always hold cold foods below 41º F or hot foods above 140º F. Only about 36% of the hot and cold food holding observations met the Food Code's guidelines[12]. In addition, 70% of opened foods were not properly labeled or dated. These practices place consumers at an increased risk for foodborne illness. An additional inappropriate practice observed by specialists in full service operations was improper cooling of cooked foods. The Food Code recommends that foods should be cooled to 70º F within two hours, and foods should be cooled to 41º F within the next four hours[13]. If the food is not cooled to 70º F within the first two hours during step one, foods must be reheated and cooled properly or discarded[13, 14]. Following the Food Code's food handling recommendations ensures the food is safe for consumers[12].

Like fast food restaurants, personal hygiene was an issue[12]. Specialists monitored employees' handwashing, glove use, and kitchen practices to identify inappropriate behaviors, which may lead to food contamination. In addition, specialists monitored the accessibility of handwashing stations, as well as the availability of handwashing supplies. Observations revealed that over 70% of workers were not properly washing their hands, changing their gloves (57%), or following good hygienic practices (34%). Handwashing facilities should be accessible, convenient, and well stocked with soap and paper towels; however, 20% of full service restaurants did not meet this standard[12].

Almost one-third of the total sanitation/contamination observations did not meet the Food Code standards[12]. Over 50% of the observations revealed that inadequate cleaning or sanitizing

of food contact surfaces occured[12]. Additionally, almost 40% of the food storage observations did not comply with the Food Code; separation of ready-to-eat foods from raw meats represented the greatest number of errors. Additionally, full service restaurants failed to protect foods from external contaminants like dust, chemicals, pathogens, or juices from other stored foods[12]. Other errors observed were in the storage of chemicals[12]. All chemicals should be placed in a separate room or partitioned area away from food, serviceware, and preparation areas. In addition, all cleaning/sanitation products should be clearly identified and used only as directed. Almost one-third of the full service operations violated Food Code recommendations for chemical storage and usage[12].

Since the first observations in 1998, specialists had documented improvement in a majority of the food safety practices monitored in the fast food and full service restaurants[12]. Food holding in fast food operations improved by about 9%; however, full service restaurants remained virtually the same between the two observation periods. Another improvement by fast food and full service restaurants was personal hygiene compliance; they improved by 6% and 13% respectively. In addition, full service operations improved sanitation/contamination compliance by almost 10%. Unfortunately, fast food operations did not improve, and they committed more sanitation/contamination errors than previously observed. In general, specialists reported that fast food and full service restaurants demonstrated safer food handling practices during the 2003 observations[12].

***Commercial Education Programs***

One commercial educational program will be addressed by this literature review, since it specifically targets restaurant employees; few other commercial programs are available and other programs target institutional foodservices. The National Restaurant Association developed ServSafe® to educate foodservice workers and promote safe food handling in commercial operations. It is reported to be "the most widely used program for food safety education, training, and certification in the restaurant and foodservice industry"[16]. The ServSafe® program educates participants about the food safety standards during receiving, storage, cooking, holding, and serving. ServSafe® relies on the current Food Code's principles and recommendations to guide the educational content. Once employees complete the program, they are certified and have the knowledge, tools, and resources to provide safe food to the public[14, 16].

### *Consumers' Food Safety Knowledge and Practices*

Consumers perform some of the same unsafe food handling practices as foodservice employees; however, monitoring their compliance to safe food handling protocols is more difficult. Researchers have reported consumers perform improper handwashing, as well as inappropriate cooking, cleaning, and storage of foods[17, 18]. Experts recognize foods prepared in the residence contribute to the incidence of foodborne illness; yet, most Americans are not aware that 18-20% of foodborne illness cases occur in residential settings[9, 11]. Consumers incorrectly believe that foodborne illnesses are typically associated with food manufacturers, food processors, or restaurants[5, 17]. In recent years, researchers have sought to understand consumers' food safety knowledge, behaviors, and attitudes in hopes of developing educational programs to reduce the incidence of foodborne illness[11].

A majority of the consumer food safety research has been gathered through surveys, interviews, or focus groups; however, these may not be the best tools to gain accurate consumer food safety information[11]. Typically, surveys are useful to determine knowledge, but the self-reported practices queried by surveys may not represent participants' actual behaviors[11, 17, 19]. Participants often over-report "good" behaviors or may answer in a socially desirable way, which may distort the conclusions from the data[19]. Several researchers have reported that many consumers follow proper food safety recommendations[17, 18]. In fact, one researcher reported that more than 80% of the participants in the study felt they had adequate food safety knowledge[20]. Another survey reported participants washed their hands before beginning food prep at least 90% of the time[17]; however, observational studies contradict this self-reported data[21-24]. Some researchers feel that observational studies are superior since the actual behaviors are observed providing a clearer understanding of specific food safety errors committed in the residential setting[11, 22].

Fewer observational studies have been completed due to cost and time constraints, but several have revealed consumers' practices are not adequate[11]. Two separate U.S. researchers, Daniels and Anderson, have completed in-home observational studies to identify practices that may lead to foodborne illness[21, 22]. Other researchers, Worsfold, Griffith, and Redmond, from the United Kingdom (U.K.), have completed in-home or model kitchen observational studies as well[23, 24].

Worsfold, et al. completed an observational study in 1997 and noted several errors committed by consumers in their residences; 66% of food preparers failed to wash their hands before starting food preparation, and 58% did not wash their hands after handling raw meats[24]. In addition, cross-contamination between ready-to-eat and raw foods was reported, as well as improper cleaning of kitchen counters. Further, participants did not clean one-fourth of cutting boards between food types, and leftovers were stored in the original containers[24]. The observations by Worsfold, et al. documented one unique behavior—the delayed consumption of cooked foods. Almost 60% of the participants did not consume the food immediately; they held the food at room temperature for an average of 90 minutes or longer before consuming[24]. Subsequent observational studies have revealed similar findings and conclusions[22, 24, 25].

Daniels, from the U.S., observed meal preparation by consumers in their home, and he reported that 99% of the observations did not meet the same food safety standards as required for restaurants[21]. He observed that 57% of the participants failed to wash their hands at appropriate times, 76% committed cross-contamination errors, and 92% of the households misused kitchen sponges or cloths[21]. In addition, Daniels monitored thermometer usage and reported they were not frequently utilized in the residential setting to measure end-point cooking temperatures; only 8% of the participants used a food thermometer[21]. Other food safety errors reported by Daniels included improper cooling and covering of leftovers, as well as refrigerator temperatures measured above 41º F[21].

In another observational study, Redmond and Griffith reported that 100% of the participants failed to wash their contaminated hands at least once during the preparation of a chicken salad[23]. Furthermore, they reported several incidences of cross-contamination such as not washing knives, cutting boards, or counter tops after direct contact with raw chicken or packaging[23]. Subsequently, 29% of the finished chicken salads or preparation environments were contaminated with *Campylobacter* following the observation (determined by swabbed samples). A recent study by Anderson, et al. reported similar errors were committed by consumers; in addition they documented other sources of errors by food preparers in the residential setting[22].

Anderson, et al. observed participants (n=99) while making dinner (meat entrée and fresh salad), from raw ingredients and compared their practices to the *FightBac!*® educational campaign, which emphasizes four food safety concepts: clean, separate, cook, and chill[26]. The

first *FightBac!*® recommendation is clean, and most commonly addresses the cleanliness of hands, kitchen surfaces, and produce[22, 26]. More than half of the food preparers neglected to wash their hands before beginning food preparations and only one-third of the total handwashing observations (n=433) included soap. Like other researchers, Anderson and colleagues reported surfaces were inadequately cleaned; only 29% of surfaces were cleaned after direct contact with raw meat. While preparing salad, few properly washed the vegetables; in fact, six participants did not attempt to wash any of the salad items.

Separate, the second *FightBac!*® recommendation, addresses cross-contamination between raw and ready-to-eat foods during storage, preparation, or while serving. Cross-contamination occurred often—only two of the 99 participants did not contaminate their ready-to-eat products during preparation in the study by Anderson[22]. They determined hands to be the most common vector of cross-contamination, and accounted for 51% of the errors during food handling[22].

The third *FightBac!*® recommendation, cooking, focuses on how participants determined the doneness of foods. Anderson reported that only 5% of the participants determined doneness of the meat entrée with a thermometer, which resulted in 61% of the chicken and 46% of the meatloaf entrées being undercooked[22]. In fact, more than half of the participants did not know the correct end-point cooking temperatures of chicken or ground beef when asked[22].

The final *FightBac!*® recommendation is chill, and addresses holding of foods, storage of leftovers, and refrigeration protocols. Several participants committed errors in this category[22]. One entrée recipe required the meat to be marinated, and 77% of those preparing this dish marinated the meat incorrectly—on the counter top[22]. Additionally, researchers observed the storage of leftovers[22]. None of the participants divided the leftovers into smaller portions to cool more quickly; 44% of the group making meatloaf stored the leftovers in the original cooking pan with a cover. Both of these practices are incorrect for storing leftovers. In general, researchers concluded that consumers did not follow the *FightBac!*® guidelines[22]. Anderson's work supported previous findings of Daniels, Worsfold, et al., and Redmond, et al.

Food safety experts agree, that consumers lack food safety knowledge, and they practice unsafe food handling in their own kitchens[11, 17]. All of these observational studies, now dated, have reported that consumers commit significant food safety violations. Researchers suggest

that consumer educational programs and continued research are key strategies to improve the food safety behaviors in the residential setting[17].

### *Consumer Education Programs*

Government, consumer, and industry groups have created consumer educational programs to address the growing food safety problem in the U.S. However, a small volume of the educational information is directed toward mature adults. These programs available for consumers include *FightBac!*® (described above), which emphasizes four main topics: clean, separate, cook, and chill[27]. The Department of Agriculture's website features another well-known food safety program, *Be Food Safe*™, and highlights similar concepts as *FightBac!*®[27]. Two additional consumer educational campaigns, *The Thermy*™ and *Is It Done Yet?*, encourage consumers to use thermometers to ensure meat has been thoroughly cooked[27]. The American Dietetic Association and ConAgra Foods have collaboratively developed a consumer education program, *Home Food Safety . . . It's in Your Hands*®. The program's mission was to inform consumers of their food safety responsibilities at home[28]. Four main concepts similar to those presented by the *FightBac!*® are presented in the program.

## *Characteristics of Mature Adults in the United States and Susceptibility to Foodborne Illness*

Defining the term "mature" or "older adult" is difficult. Many programs designed to assist or support the aging population use different chronological age criteria to determine eligibility, and age alone does not determine the health or abilities of a person. For this specific research project, persons aged 55 years and older were deemed to be "mature adults" and subsequently that definition is reflected in this work. The following section describes the population and health of mature adults, and presents characteristics that increase their susceptibility to foodborne illness.

The mature adult population in America is increasing and will continue for the next several decades[29]. In 2008, the U.S. Census Bureau estimated that those aged 55+ years accounted for approximately 24% of the total population, and by 2050 mature adults are projected to represent 31% of the total population[6]. Those aged 85 years and older will become the fastest growing age group in the United States[30]. In 2008, non-Hispanic whites accounted for a majority (81%) of the mature adult population, while Blacks, Hispanics, and Asians

represented 9%, 7%, 3% respectively[6]. In the future, this population is expected to become more ethnically diverse. Non-Hispanic whites will still account for the majority; the percent of Hispanics, Blacks, and Asians will increase to 19%, 13%, and 9% by 2050[7].

Other defining characteristics of this group include education level, marital status, and financial status. Eighty-one percent of mature Americans have a high school diploma and 24% have a bachelor's degree or above[31]. More men than women have completed a bachelor's degree; however, more women have graduated from high school[31]. Almost 63% are currently married and a vast majority, 77.3%, work full time[31]. Currently, mature adults are financially stable, and fewer live below the poverty level than in previous generations[32].

The health of mature adults in the 21st century varies greatly from individual to individual, and is different from other generations. In fact, they are enjoying an active lifestyle longer than ever before[33]. Those born in the early 1900's have experienced the greatest increase in life expectancy ever—their life expectancy has increased by 30 years[33]. More than 80% of the people between the ages of 55 and 64 years of age report their health as being good, very good, or excellent[34]. Those aged 65+ years also report themselves as being healthy with almost 75% describing their health as good, very good, or excellent[34]. Even though the reported health of this group is good to excellent, some normal changes associated with the aging process places mature adults at an increased risk for foodborne illness[3].

Many people are aware of changes that may occur in memory, vision, strength, or flexibility; however, few may realize changes occurring in the immune system. Immune function tends to decline with increasing age, and response to harmful pathogens is not as quick or effective as in earlier life[3, 35]. Other changes associated with aging involve the gastrointestinal tract, which is a protector against foodborne illnesses[3]. Specifically, the amount of stomach acid and the transit time of food through the gastrointestinal tract are affected by aging[3]. Mature adults may produce less stomach acid potentially increasing the number of organisms entering the lower gastrointestinal tract; therefore, increasing the chance of foodborne illness[5, 36, 37]. Reduced gastrointestinal motility, which also occurs, allows harmful organisms or toxins to be present in the gastrointestinal tract for longer[37]. Additionally, the senses of taste and smell change in acuity[3]. Normally the taste or smell of spoiled foods would prevent consumption, but blunted senses may not detect these changes in foods[3].

Other factors may also contribute to mature adults' susceptibility to foodborne illness such as: other diseases, side effects of medications, and/or lack of appropriate food handling knowledge[3, 4]. The CDC estimates that 80% of mature adults have at least one chronic disease, and 50% have two or more[38]. Common chronic diseases in mature adults are heart disease, cerebrovascular diseases, cancer, diabetes, or arthritis[39]. Having multiple illnesses can tax the immune system reducing the body's ability to fight infections. Even a mild infection, like some foodborne illnesses, becomes difficult to resist when the immune system is challenged.

Side effects of over-the-counter or prescription drugs may alter the body's natural defenses and increase mature adults' susceptibility to foodborne illness. Approximately 90% of men and women over 65 years old use one or more medications per day, and almost half of this population use five or more medications a day[40]. Side effects include changes in gastric motility, gastrointestinal flora, and/or stomach pH[3]. The use of antibiotics by mature adults is also high, and this too can increase susceptibility.

Mature adults report having sufficient food safety knowledge, but researchers have identified gaps in their knowledge, which may place them at risk[4, 5, 37, 41, 42]. Many mature adults did not recognize the proper way to check the doneness of meat, correct end-point cooking temperatures, or the length of time food can be at room temperature before it is considered unsafe[5]. Many mature adults did not consider some foods to be high-risk, which may increase risk[5]. Other researchers have revealed that mature adults were not aware of their inappropriate practices, such as eating raw cookie dough, judging the doneness of hamburger by color, or cooling foods in large batches[4, 5]. Like the general population, mature adults report knowing and practicing safe food handling; however, some surveys and observational studies report that mature adults lack proper food safety knowledge and commit several errors that may increase risk of foodborne illness[23].

### *Reported Food Safety Knowledge and Practices of Mature Adults*

A small volume of the food safety research focuses on the mature adult population; therefore, few details are known about the food safety knowledge and practices of this population. Many do possess some food safety knowledge and follow safe food handling recommendations. However, food safety experts have identified several areas such as hand washing, food handling, and food preparation that need improvement[5, 41-43]. Mature adults' food

safety knowledge may have been acquired through observations in families, as well as gathered from newspapers, magazines, television, and/or the Internet[41]. This knowledge may not represent current food safety recommendations, which can be problematic[4, 41].

In 1998, researchers from the U.K. completed one of the first studies that targeted mature adults' (65 years and older) food safety knowledge and practices[43]. They investigated food storage knowledge and practices of 645 independently living mature adults. The most significant finding was that 70% of the study participants had refrigerators too warm for safe food storage (above than 42º F). Other findings suggested that the phrases "use by" and "sell by" dates were understood; yet, the labels were difficult to read for 45% of the participants[43]. Subsequent studies in the U.K. have reported similar results. In a 2002 study, most respondents (90%) did not know the proper refrigerator temperature, or they did not regularly measure the temperature of their refrigerator[44]. Additionally, researchers observed refrigerators that were overcrowded, unorganized, and contained foods without lids[44]. These results may indicate that mature adults misunderstand refrigerator storage, temperatures, and safety.

Sellers, et al., from Georgia, studied senior center participants' (n=92) food safety practices before and after a food safety educational intervention[42]. The group consisted mainly of Caucasian (61%) women (75%) with a mean age of 79±7. Sellers and her colleagues administered a pre and post questionnaire to the participants that addressed the four key food safety principals of the *Fight Bac!*® program—clean, separate, cook, and chill. Examples of the questions they asked were: (1) In the past month did you always wash your hands with warm water and soap for 20 seconds before eating food? or (2) In the past month did you always clean the countertops before preparing foods? The remaining questions inquired about other food safety behaviors such as preparation of produce, consumption of foods with raw eggs, monitoring refrigerator temperatures, and separating of foods. Three conclusions were drawn from the pre-test results: (1) about 20% of participants reported not following the Fight Bac!® recommendations, (2) about 25% of participants did not wash their hands prior to eating or preparing foods, and (3) over 80% did not use refrigerator or meat thermometers. After the educational intervention, improvements in all categories were observed, except one, consuming foods containing raw eggs. Statistically significant improvements in handwashing were reported; nonetheless, little improvement was reported in thermometer usage. Sellers and colleagues observed a correlation between age and home food safety practices—the younger

group reported more safe food handling at the pre-test and the older group reported greater improvements in safe food handling practices after the intervention (younger and older groups were not defined by the authors). Other conclusions drawn were: (1) food safety problems were evident in the mature adult population, (2) food safety practices varied greatly among mature adults, and (3) food handling education did improve residential food safety practices in that population[42].

Gettings and Kiernan conducted research using six food safety focus groups with 74 participants at senior centers in Pennsylvania[4]. The participants were mostly females (88%), 60-85 years old, and represented both urban (45%) and rural (55%) participants. The discussions centered on the participants' cooking, cooling, and thawing practices; participants utilized both appropriate and inappropriate food safety practices. While cooking, mature adults used several incorrect practices to determine doneness of meat such as cooking time, visual cues, and changes in consistency. However, one correct practice was discussed and reported by some of the participants—the use of a food thermometer. The groups employed fewer inappropriate food-cooling practices; however, one error, cooling large portions of hot foods at a time, was cited by most of the focus groups. Several of the focus groups did report practicing appropriate cooling techniques like refrigerating foods within two hours, dividing leftovers into smaller portions to cool quicker, cooling foods by placing them in cold-water baths, and placing hot foods outside when the temperature was below 40º F before refrigerating (this last practice was deemed acceptable by the authors). The last practice evaluated by Gettings, et al. was thawing, and several inappropriate techniques were reported. First, almost all groups reported placing food in unchanged water to defrost, which is inappropriate. If foods are to be defrosted in water, cold water must be used and the water should be continuously run over the product until thawed[14]. Fewer groups mentioned placing food on the counter longer than two hours to defrost or defrosting in the microwave without immediately cooking. Gettings, et al. discussed a variety of food safety topics in their focus groups, and they cited that mature adults used both, appropriate and inappropriate practices, and participants' knowledge comes from the past. In addition, they compared their findings with previous research, and they concluded that their participants utilized more inappropriate practices than the general population[4].

Researchers from Kansas State University have also investigated the topic of food safety in the mature adult population[5]. They conducted a national telephone survey of adults aged 65

years and older to evaluate their food handling attitudes, knowledge, and behaviors, as well as to determine their perceived risk of foodborne illness. Overall, participants reported positive attitudes towards food safety, sufficient food safety knowledge, and acceptable food handling behaviors, but some improvements were necessary. Areas needing attention were knowledge of end-point cooking temperatures and proper storage of leftovers. For example, a majority (57%) of the respondents did not know the proper end-point cooking temperature of a hamburger patty. Additionally, two behaviors raised concern among the researchers—the consumption of risky foods and not using food or refrigerator thermometers. Over one-third of the participants reported eating runny eggs, which may increases the risk of contracting a foodborne illness. In addition, 26% of the respondents said they ate homemade raw cookie dough and/or raw sprouts, which have been recently linked to *Salmonella* outbreaks[14]. Less than half of the group reported monitoring refrigerator temperatures with a thermometer, and even fewer respondents, 9%, determined the doneness of meat with a thermometer[5].

Last, the researchers evaluated how mature adults perceived their risk of contracting a foodborne illness[5]. Researchers evaluated participants' risk perception by asking questions about where they deemed foodborne illnesses to originate, the seriousness of contamination by pathogens, and the risk associated with certain foods. Mature adults believed that foodborne illnesses were most commonly attributed to food processing plants (48%), followed by the home (20%), and restaurants (16%); yet, a follow-up question indicated respondents were least worried about foods prepared in the home. When researchers asked about the seriousness of foods contaminated by pathogens, only a little over half (56%) thought it was a "very serious" or "serious" concern. Furthermore, participants did not identify certain foods (raw eggs, raw sprouts, or raw oysters) as being high-risk foods. Additional findings of importance during data analysis revealed a relationship between higher education and negative food safety attitudes, lower perception of risk, and poor food safety behaviors. Researchers concluded that food safety education should be reevaluated and target people with higher education, focus on specific risky foods, and address behaviors that increase an individual's risk[5].

Researchers at Kansas State University completed a follow-up to the above study to clarify some of the findings. Eight focus groups were conducted with Kansans 65 years and older to identify their food safety knowledge, attitudes, and perceptions of foodborne illness risks. The groups' discussions focused on participants': (1) concerns of food safety, (2)

perceptions of control over food in their own homes, (3) usage of thermometers, and (4) implementation of new food handling practices. Participants' concerns focused on the cleanliness of commercial operations, food preparers, foods, and surfaces, as well as the presence of microorganisms in foods, the safety of certain foods, and food safety while eating away from home. Participants identified their ability to monitor foods, date and store foods quickly and wash produce as being in their control in their homes; however, the researchers did not state what participants perceived as out of their control. Conversations surrounding the theme of thermometer usage varied and ascertained several inappropriate techniques to determine the doneness of meats—appearance, texture, or the use of a cooking utensil. The conversations led researchers to believe that mature adults do not typically utilize food thermometers while cooking. The last topic addressed by researchers was implementation of new practices. Participants reported what would encourage them in changing their current habits, such as ease, convenience, fear, media coverage, or interesting presentations. Factors that would discourage them from changing their behavior are the cost, time, knowledge, food appearance, traditions, and habit. The researchers concluded that mature adults do have general food safety knowledge, but employ several inappropriate practices while preparing foods in their homes. Some of these practices are delays in refrigerating prepared foods, not using meat thermometers, improper cleaning and storage of foods, and consumption of some high-risk foods. The article supports previous work and illustrates the need for food safety education in the mature adult population[41].

The last article, an observational study conducted by Redmond, et al., evaluated food preparation practices of three distinct groups of people—matures adults (60-75 years old), mothers of young children, and single young men[45]. Researchers chose these specific groups for two main reasons: (1) mature adults and young children are known to be vulnerable to foodborne illness and (2) single young men report risky food handling behaviors and consumption of high-risk foods[18, 46]. The study's purpose was to document the incidence of inappropriate food handling practices during the preparation of a chicken and pasta salad from raw ingredients. Researchers monitored the entire process by closed circuit video cameras and documented food safety behaviors on a comprehensive checklist. The inappropriate food handling practices were numerically scored using a system developed by the authors. A final risk score was tabulated for each participant for comparison. The scores ranged from 320 to 11,060 with the lower number representing the fewest food handling mistakes. All participants

committed errors, which included inadequate or failure to wash hands, improper cleaning of counters or cutting boards after contact with raw chicken, using contaminated utensils while cutting up ready-to-eat foods, and wiping contaminated hands on dish towels that were subsequently used to dry clean utensils or hands. These errors contaminated some of the final products with *Campylobacter*. They concluded that all participants committed food safety errors and that 80-86% of the errors involved cross-contamination. Additionally, those aged 60-75 years old committed more food safety errors than the other groups[23].

### *Eating Away From Home*

Over the last several decades, Americans have spent far more on meals away from home than before. In 1955, only 25% of the food dollar was spent in restaurants[47]. Today almost 50% of the food dollar is spent in commercial operations[47]. Since 1970, restaurant sales have significantly increased, and sales are expected to exceed 566 billion dollars in 2009[47]. Additionally, commercial operations will provide an estimated 130 million meals a day totaling over 70 billion meals in 2009[47]. Several changes have contributed to the increase in commercial sales. In particular, changes in family dynamics such as increased single working parents or both parents working outside the home, higher income, and busier lifestyles[48]. Furthermore, Americans tend to have less food preparation skills and knowledge, and the options available from a commercial operation will typically satisfy the desires of all family members[48]. Mature adults are a part of the changing food environment, because they too have increased their spending on foods away from home. From 2000 to 2004 spending on meals away from home increased by 33% for Americans aged 55 years and older[8].

Restaurants contribute to the incidence of foodborne illness, and approximately 52 to 59% of reported foodborne illnesses in the United States are associated with commercial operations[9, 10]. Few studies, specifically consider consumer perceptions of food safety in commercial operations. Nevertheless, it is clear that Americans are spending more money at commercial operations and restaurants are a noteworthy source of foodborne illness. This study investigates consumers' perceptions of food safety in commercial operations. The next section of this chapter details two important research questions, which are the subject of this research.

## Research Questions and Forecast of Thesis Chapters

This thesis seeks to evaluate food safety knowledge among mature adults in Kansas. Specifically, this research project explores two questions:

1. What is the food safety knowledge among mature Kansans aged 55 years and older?
2. How does the food safety knowledge of mature Kansans influence their concerns while eating away from home?

The research objectives addressed by this study were rooted in the above research questions. To answer the first research question, this thesis evaluated mature adults' food safety knowledge in the following areas: (1) *hand washing*; (2) *food handling*, (3) *food preparation*, and (4) *foodborne illness symptoms*. Furthermore, their food safety knowledge was compared by age, gender, educational attainment, and geographic location. To answer the second research question, this thesis determined whether mature adults had food safety concerns while eating away from home, as well as whether a correlation existed between these concerns and their food safety knowledge.

The following chapters of this thesis detailed the methods, results, and conclusions of this research project, designed to gain insight into mature adults' food safety knowledge and concerns while eating away from home. A detailed description of the cohort and the data collection instrument is presented in chapter two. Chapter three, which has subsections, features the findings regarding the food safety knowledge of mature Kansans, and their food safety concern while eating away from home. In addition, chapter three presents the results and conclusions drawn from the data analyses, as well as limitations and recommendations for future research. Chapter four presents a manuscript prepared for publication.

As of December 2009, more researchers are exploring mature adults' food safety knowledge, practices, and concerns, but limited research exists detailing their concerns of foods prepared outside of their home. Further investigation is crucial due to the rapidly growing mature adult population, their higher susceptibility for foodborne illness, and the increased consumption of foods away from home. Therefore, this thesis will contribute to a new dimension of food safety research and adds to the growing body of literature addressing mature adults and food safety.

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# CHAPTER 2 - Methodology

This chapter details the methods employed to answer the research questions presented in chapter one. The first section of this chapter restates the research questions followed by a description of the subjects and the selection procedure. The third section reviews the strengths and weaknesses of survey methodology, and the fourth discusses the development and administration of the data collection instrument. The final portion of this chapter describes the data analysis planned to address the research questions and objectives.

The United States Department of Agriculture's Cooperative State Research, Education, and Extension Service, grant number 000648, provided support for this research. This project is part of a larger research project entitled Multimedia Food Safety Training Program for Community-Based Older Adults. The methods discussed below pertain only to the project titled: The Relationship Between Mature Kansans' Food Safety Knowledge and Their Concerns While Eating Away From Home. Approval from the Kansas State University Institutional Review Board was obtained prior to initiating this project.

## Research Questions Revisited

The thesis explored food safety knowledge and concerns of mature Kansans in two geographic locations. Two questions are the basis for this research project:

1. What is the food safety knowledge among mature Kansans aged 55 years and older?
2. How does the food safety knowledge of mature Kansans influence their concerns while eating away from home?

In addition, this research evaluated the *handwashing, food handling,* and *food preparation* knowledge of mature Kansans along with their ability to identify *foodborne illness symptoms*. This information addressed the first research question. Another facet of this research provided insight into mature Kansans' food safety concerns while eating away from home and aided in answering the second research question.

## Subjects and Site Selection

This study targeted community-based, English speaking men and women, aged 55 years and older living in Kansas. This group represented approximately 23% of the state's total population[1]. A convenience sample size of approximately 110 subjects was targeted from two of the eleven Area Agency on Aging districts in Kansas. The sample size was determined by the funding grant, and statistically represented mature adults living in those districts. District 1 is located in the northeastern region of the state and includes Leavenworth and Wyandotte counties. District 2, the Central Plains Region, encompassed the Wichita area including Butler, Harvey, and Sedgwick counties. These two districts represented approximately 29% of the state's total population, and 26% of mature Kansans (over 55 years old) reside in these two districts[2, 3].

Participants were recruited from various organized sites including senior centers, community college groups, and programs suggested by Cooperative Extension personnel or others working with the target population. Various program directors were contacted by telephone to elicit interest in the project and gain permission to administer the questionnaire. Individual appointment times were set up to collect data from sites that agreed to participate. A brief research abstract was prepared for anyone who requested printed information in advance.

## Merits and Limitations of a Survey Methodology

Researchers have used survey methodology for decades to gather detailed and often sensitive information from individuals in a sample population. The data can be used to describe, explain, explore, or generate a hypothesis for a larger population[4]. For example, restaurants asking patrons to fill out a card regarding their staffs' performance, food manufacturers seeking consumers' input on a new product, or researchers trying to evaluate the knowledge of a group are all common uses of surveys in the United States. Some researchers use questionnaires to elicit information from participants, while other researchers utilize a structured telephone or personal interview to gain insight into a population. Surveys have become a common tool to gain information from individuals to better understand or describe the characteristics of a group or service.

Surveys have several strengths that render them desirable. First, surveys provide a convenient and inexpensive mode of acquiring the same information from numerous cohorts at one time, and they are particularly suitable for extremely large samples[5]. In addition, a survey

can address several interrelated topics at a time; for example, a survey may address several facets of food safety in one questionnaire. Another advantage of the survey method is a standardized questionnaire[4]. A standardized questionnaire exposes each participant to the same questions, in the same format with the same directions, which increases the consistency of the researcher's data[4]. Additionally, surveys allow the researcher to tailor the questions to specific objectives, and questions can appear in a variety of formats.

Another advantage of surveys is the variety of distribution methods. They may be distributed face-to-face, via the Internet or mail, as well as via the telephone. Surveys have a unique advantage since they can be administered in a supervised or unsupervised setting, which provides more flexibility for the researcher. Surveys administered in a supervised setting typically increase the response rate, encourage respondents to ask for clarification, and reduce the turnaround time for data collection and analysis since questionnaires can be gathered at the end of the session[5, 6]. Generally, questionnaires are useful data collection instruments and can be applied to many facets of research.

Although surveys prove useful, this method has some limitations. First, developing a clear and concise questionnaire without creating biased results is difficult[4, 7]. Researchers must contemplate the wording, the question location, and content of every question because a misplaced word or question can lead to misinterpretation and biased responses[7]. Furthermore, researchers must make some assumptions about the respondents. For example, researchers assume literacy, comprehension of the language used, and the competency of the respondent to answer the questions[4]. If any of these assumptions are incorrect, results will be flawed. In addition, researchers must also assume respondents have some knowledge or feeling towards the questionnaire topic. If participants are forming, an opinion while completing the questionnaire it may skew the results[4]. Another limit of survey methodology is the use of self-reported information, which may be inaccurate or biased if questions address socially desired behaviors thoughts, or attitudes[5]. For example, respondents may be hesitant to report they do not wash their hands after using the restroom. In general, people like to portray them in a positive fashion, and may over-report perceived desirable behaviors[8].

Beyond the limitations of researchers' assumptions and self-reported information, surveys should produce results with minimal errors. Survey errors may occur in four areas (coverage, sampling, nonresponse, and measurement) and careful planning can reduce or

eliminate most errors[8]. Coverage errors occur when not everyone in the population has an equal opportunity for selection. For example, a coverage error would be conducting an Internet survey in an area that had limited Internet access; not everyone in the area would be able to participate in the survey. Sampling errors are an inherent part of all surveys, and occur because a small portion of the population is observed not the entire population. The characteristic of interest will vary slightly from sample to sample; consequently, researchers increase the sample size to achieve an acceptable sampling error. However, a sampling error will always be present. Another error, nonresponse, is typically associated with mail surveys and originates from respondents not returning their surveys. Nonresponse errors represent a problem because the information from non-responders may be different and affect the study's outcomes. Measurement errors arise when respondents report inaccurate or vague answers. These types of errors are often related to unclear questions or poorly designed questionnaires. Researchers take many steps while determining their survey type and administration, determining the sample size, and developing the survey tools to reduce these error[8]. Surveys have limitations like any research tool and understanding these enables researchers to utilize them effectively.

## Questionnaire and Administration

The questionnaire used for this study was developed following an elicitation study conducted in eleven sites throughout the state of Kansas. Discussions following this process were instrumental in the development of the final questions used, as well as providing insight into the food safety knowledge and practices of mature Kansans. The questionnaire was pilot tested in three mature adult audiences. Several food safety experts evaluated the questionnaire before administration to ensure content validity. Changes in the questionnaire's word choices and presentation were made following each pilot test. The final version specifically addressed food safety knowledge, practices, and attitudes of mature adults and ascertained information regarding their preferences for and use of technology, dining habits, high-risk food consumption, and demographics. Three core food safety constructs were addressed in the knowledge, practices, and attitudes sections: (1) *handwashing*, (2) *food preparation*, and (3) *food handling (foodborne illness symptoms* was only addressed in the knowledge section). The complete questionnaire included 53 questions in a variety of formats (multiple choice, scale, frequency, and open-ended) and was fifteen pages in length.

The self-administered questionnaire was distributed to persons that met the criteria: 55 years of age or older, adequate mental capabilities, and residing in one of the Area Agency on Aging districts. A short description of the study was presented at each site, and volunteers were invited to participate. During questionnaire completion, participants were encouraged to raise their hands if they had questions and complete the questionnaire individually. Assistance was provided only as needed, and questionnaires were collected at the site following completion. It took approximately 30-40 minutes to complete the questionnaire, and participants received a refrigerator thermometer as a token of appreciation for participating.

## Data Analyses Planned

For this research project, three sections of the questionnaire were analyzed to answer the research questions; the sections were titled: (1) Food Safety Knowledge, (2) Eating Out, and (3) Demographics. The first section, Food Safety Knowledge, consisted of ten multiple-choice questions addressing the first research question (What is the food safety knowledge among mature Kansans aged 55 years and older?). This section queried their knowledge of *foodborne illness symptoms* followed by questions about mature adults' *handwashing, food handling,* and *food preparation*. The *handwashing* questions ascertained mature adults' knowledge for when handwashing should occur, supplies necessary, and appropriate hand drying techniques. The next three questions addressed proper *food handling* including preparation of produce, examples of cross-contamination, and methods for storage of leftovers. The last questions assessed their knowledge of *food preparation*, and focused on cooking and thawing of foods, and the appropriate internal temperatures of cooked foods. During analyses, the frequency and percent of correct responses were calculated, as well as determining an *overall* food safety knowledge score for each of the four food safety constructs (*handwashing, food handling, food preparation,* and *foodborne illness symptoms*). The *overall* food safety knowledge score is the mean correct responses for each construct.

An additional section, Eating Out, utilized six questions to evaluate mature adults' habits and food safety concerns while eating out. These questions helped answer the research question: How does the food safety knowledge of mature Kansans' influence their concerns about eating away from home? Two multiple-choice questions gathered information about their general food safety concern and the type of meals (breakfast, lunch, or dinner) consumed away from home.

Additionally, respondents reported the frequency of eating at a restaurant, a friend's home, or a community base meal site during the previous week by selecting one of the available categories: none, 1-2 times, 3-5 times, 6-8 times, 9-11 times, and greater than 12 times weekly. An additional question ascertained their food safety concerns in these three food preparation sites on a zero (no concern) to four (significant concern) scale. The following question, allowed respondents to rate their concerns on a zero to four scale for specific food safety violations that may occur in a commercial operation. The violations addressed employee hygiene, overall facility cleanliness, food preparation, and food handling. The final question is open-ended, which asked participants to list other safety concerns while eating out. Descriptive statistics were utilized for this section, as well as means and standard deviations for the two scale questions.

Demographic information was the last collected and was used for comparison among groups. This research utilized three specific demographic questions to compare the food safety knowledge of mature adults related to age, gender, and educational attainment. In addition, the knowledge of respondents were contrasted between geographical locations (Area Agency on Aging Districts 1 and 2). All demographic questions were multiple-choice with one exception—the final question ascertained the age of the individual and was fill-in-the blank.

Once the data collection was completed, the information was entered into Statistical Program for the Social Sciences (SPSS), and evaluated. Descriptive statistics, frequencies, means, and standard deviations provided insight into mature adults' food safety knowledge and concerns. Independent t-tests and analysis of variance (ANOVA) provided further analyses regarding the relationship between mature Kansans' food safety knowledge and the variables of age, gender, educational attainment, and geographic location. ANOVA post hoc analysis was performed by Hochberg's GT2 pairwise test, which was appropriate for unequal sample sizes with equal variances[9]. Additionally, Pearson's correlation determined whether an association existed between food safety knowledge and food safety concerns. Results were considered statistically significant at a $P \leq 0.05$.

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# CHAPTER 3 - Results and Discussion

This section features results and discussion pertaining to two research questions evaluating four constructs of food safety knowledge in the mature adult population, as well as their concerns about food safety while eating away from home. The following chapter is divided into five sections: (1) Demographics, (2) Research Question One—Mature Kansans' Food Safety Knowledge, (3) Research Question Two—Mature Kansans' Food Safety Concerns While Eating Away From Home, and (4) Discussion, and (5) Conclusions.

## Results

### *Demographics*

Participants were from two Area Agency on Aging districts in the state of Kansas, and about 26% of the total mature adult population resides in these two districts[1]. Respondents represented a predominately white, female population ranging in age from 56 to 94 years with a mean of 71.6 ± 10.0. The sample was comprised of 35.2% men and 64.8% women, which is closer to the actual American population (45% and 55% respectively in 2008) than previous studies[10]. The majority (66%) had a high school diploma followed by those receiving a college degree, an advanced college degree, and an eighth grade education. District 1 (Leavenworth and Wyandotte counties) and District 2 (Butler, Harvey, and Sedgwick counties) represented 35.7% and 64.3% of the sample. The participants from each district differed in mean age, gender, and educational attainment; District 1 had a greater percentage of males and participants achieving an eighth grade education. One-hundred and forty food safety questionnaires were completed; however, responses to individual questions varied due to incomplete or missing replies. Table 2 (next page) details the demographics of the population.

**Table 2. Demographics**

| **Gender** (n=128) | **n**[a] | **%** |
|---|---|---|
| Men | 45 | 35.2 |
| Women | 83 | 64.8 |
| **Age Cohorts** (n=126) | **n**[a] | **%** |
| 55-65 | 46 | 36.5 |
| 66-75 | 35 | 27.8 |
| 76 and older | 45 | 35.7 |
| **Educational Attainment** (n=128) | **n**[a] | **%** |
| Graduated 8th grade | 5 | 3.9 |
| Graduated high school | 84 | 65.9 |
| College degree | 26 | 20.3 |
| Advanced college degree | 13 | 10.2 |

| **Education by Gender** (n=127) | **Men** | | **Women** | |
|---|---|---|---|---|
| | **n** | **%** | **n** | **%** |
| Graduated 8th grade | 2 | 4.4 | 3 | 4.9 |
| Graduated high school | 25 | 55.6 | 58 | 70.7 |
| College degree | 12 | 26.7 | 14 | 17.1 |
| Advanced college degree | 6 | 13.3 | 7 | 8.5 |

| **Education by Age** (n=124) | **55-65** | | **66-75** | | **75+** | |
|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | **n** | **%** |
| Graduated 8th grade | 2 | 4.4 | 1 | 3.9 | 2 | 4.6 |
| Graduated high school | 27 | 60.0 | 19 | 54.3 | 35 | 79.6 |
| College degree | 8 | 17.8 | 12 | 35.3 | 5 | 11.4 |
| Advanced college degree | 8 | 17.8 | 3 | 8.6 | 2 | 4.6 |

| **Primary Ethnicity** (n=128) | **n**[a] | **%** |
|---|---|---|
| White | 119 | 93.0 |
| Hispanic | 3 | 2.3 |
| Black | 2 | 1.6 |
| American Indian | 1 | 1.0 |
| Bi-racial | 3 | 2.3 |

| **District Demographics** | **District 1** | **District 2** |
|---|---|---|
| n= | 50 | 90 |
| Mean Age (years ± SD) | 70.2 ± 10.4 | 72.1 ± 9.9 |
| **Gender** | | |
| Men (%) | 43.6 | 31.5 |
| Women (%) | 56.4 | 68.5 |
| **Educational Attainment** | | |
| Graduated 8th grade (%) | 7.7 | 2.2 |
| Graduated high school (%) | 69.2 | 67.0 |
| College degree (%) | 10.3 | 24.7 |
| Advanced college degree (%) | 12.8 | 9.0 |

[a] *n=140; due to non-respondents totals may not equal 140 or 100%*

### *Research Question One: Mature Kansans' Food Safety Knowledge*

Food safety knowledge among mature Kansans aged 55 years and older was measured by analyzing the responses to ten food safety knowledge questions. The questions addressed three food safety constructs (*handwashing, food preparation,* and *food handling*), as well as *symptoms of foodborne illnesses*. Selection of correct responses varied greatly and ranged from 98.6% of the participants recognizing foods should not be defrosted in a cold part of the house to only 5.7% of the participants identifying air-drying hands as a desirable practice. Participants correctly answered the greatest percent of *hand washing* questions (76.8% ± 0.1) followed by *food handling* (74.2% ± 0.1), *food preparation* (70.0% ± 0.1), and *foodborne illness symptoms* (69.1 ± 0.3). Overall participants correctly replied to 73.3% ± 0.10 of the ten food safety questions. Descriptive analyses are presented in Table 3.

**Table 3. Correct Responses and Percentages to the Knowledge Questions**

| *Food Safety Concept* | *n* | *Score ± SD* | *%* |
|---|---|---|---|
| FBI Symptoms[a] | 135 | 4.1 ± 1.9 | 69.1 |
| Handwashing[b] | 135 | 13.8 ± 2.6 | 76.8 |
| Food handling[b] | 137 | 13.4 ± 2.1 | 74.2 |
| Food preparation[b] | 132 | 12.6 ± 2.1 | 70.0 |
| Overall food safety[c] | 128 | 44.0 ± 5.9 | 73.3 |

n=140; due to non-respondces n does not equal 140
[a]The highest possible score is 6.
[b]The highest possible score is 18.
[c]The highest possible score is 60, which is a composite of the above four concepts.

Within each of the four food safety constructs above, some individual food safety category topic areas need further attention (if the correct response rate was below 70%, the area was considered to need further attention). Three foodborne illness symptoms, dizziness, fever, and headaches, were not adequately recognized. Additionally, five of the eighteen *handwashing* responses were correctly chosen less than 70% of the time. Generally, participants correctly identified when hands should be washed, appropriate techniques, and necessary supplies; however, participants lacked proper hand drying knowledge. Several responses pertaining to *food handling* also needed further attention. In this category, participants did not fully understand the proper procedures to clean cutting boards after use or how to wash melons.

Furthermore, less than half of the respondents recognized the importance of using a refrigerator thermometer, and only 45% of the participants could correctly identify the duration of time leftovers should be kept. Additionally, respondents lacked knowledge concerning safe *food preparation*. Areas needing further attention included correct food cooking temperatures, thawing practices, as well as determining the doneness of foods. Changes in visual cues and length of cooking were identified by 55-65% of participants as appropriate techniques to determine whether foods were thoroughly cooked, which neither are acceptable techniques.

The food safety knowledge responses of mature adults were compared by age, gender, educational attainment, and geographic location. Differences by gender and geographic location were analyzed using independent t-tests. Only one food safety concept, *food handling*, revealed a statistically significant difference by gender ($P \leq 0.03$) (Table 4). Generally, women scored higher than men; however, no significant differences by gender were found in *overall* food safety knowledge. In contrast, a difference in knowledge between the districts was discovered (Table 5). Statistically significant differences were related to *handwashing* ($P \leq 0.048$), *food handling* ($P \leq 0.011$), and *overall* food safety ($P \leq 0.027$). District 2 consistently scored higher in these three areas.

**Table 4. Food Safety Knowledge Scores by Gender**

| | *Mean ± SD (n)* | | | |
|---|---|---|---|---|
| ***Dependent Variable:*** | ***Men*** | ***Women*** | ***t =*** | ***P =*** |
| FBI Symptoms[a] | 4.0 ± 1.9 (45) | 4.4 ± 1.8 (80) | -1.2 | 0.22 |
| Handwashing[b] | 14.2 ± 2.6 (45) | 13.9 ± 2.4 (80) | 0.56 | 0.57 |
| Food handling[b] | 12.9 ± 2.4 (44) | 13.8 ± 1.8 (82) | -2.24 | 0.03 |
| Food preparation[b] | 12.4 ± 1.7 (44) | 12.8 ± 2.2 (77) | -1.04 | 0.30 |
| Overall food safety[c] | 43.3 ± 5.4 (44) | 45.1 ± 5.1 (75) | -1.76 | 0.08 |

n=140; due to non-respondces n does not equal 140

[a]The highest possible score is 6.

[b]The highest possible score is 18.

[c]The highest possible score is 60, which is a composite of the above four concepts.

**Table 5. Food Safety Knowledge Scores by Geographic Location**

| | *Mean ± SD (n)* | | | |
|---|---|---|---|---|
| ***Dependent Variable:*** | ***District 1*** | ***District 2*** | ***t =*** | ***P =*** |
| FBI Symptoms[a] | 4.0 ± 2.2 (45) | 4.2 ± 1.7 (90) | -0.78 | 0.44 |
| Handwashing[b] | 13.2 ± 3.0 (46) | 14.2 ± 2.3 (89) | -2.01 | 0.05 |
| Food handling[b] | 12.7 ± 2.4 (47) | 13.7 ± 1.9 (90) | -2.60 | 0.01 |
| Food preparation[b] | 12.7 ± 2.0 (44) | 12.7 ± 2.2 (88) | 0.52 | 0.60 |
| Overall food safety[c] | 42.1 ± 6.8 (41) | 44.8 ± 5.2 (87) | -2.27 | 0.03 |

n=140; due to non-respondces n does not equal 140

[a]The highest possible score is 6.

[b]The highest possible score is 18.

[c]The highest possible score is 60, which is a composite of the above four concepts.

Results from analysis of variance (ANOVA) indicated a statistically significant difference in food safety knowledge based on age and educational attainment. These results are presented in Tables 6 and 7. Statistically significant differences were further examined using the Hochberg's GT2 post hoc procedures (a procedure appropriate for unequal sample sizes with equal variance)[2, 3]. This sample was divided into three age groups (55-65, 66-75, and 76 years and older) for analyses, which is consistent with work previously completed for those aged 65 years and older. Virtually no food safety studies have been reported concerning adults aged 55-64. In this study, those 76 years and older had lower scores in all four constructs, and participants aged 66-75 years scored highest. Age did not influence the knowledge about the food safety constructs (*hand washing*, *food handling*, *food preparation*, and *foodborne illness symptoms*) when analyzed individually. However, statistically significant differences were observed when all of the questions were summed and analyzed as a group (*overall* food safety knowledge). Hochberg's GT2 post hoc analysis indicated a statistically significant difference existed between those aged 66-75 and those 76 years and older.

**Table 6. Food Safety Knowledge Scores by Age**

| | *Mean Score ± SD (n)* | | | | |
|---|---|---|---|---|---|
| **Dependent Variable:** | ***55-65 years*** | ***66-75 years*** | ***76 + years*** | ***F =***[d] | ***P =*** |
| FBI Symptoms[a] | 4.3 ± 1.8 (46)[x] | 4.6 ± 1.6 (35)[x] | 3.7 ± 1.9 (42)[x] | 2.44 | 0.09 |
| Handwashing[b] | 14.0 ± 2.7 (46)[x] | 14.4 ± 2.3 (35)[x] | 13.6 ± 2.4 (42)[x] | 1.13 | 0.33 |
| Food handling[b] | 13.6 ± 2.1 (45)[x] | 13.8 ± 2.0 (35)[x] | 13.1 ± 2.1 (45)[x] | 1.46 | 0.24 |
| Food preparation[b] | 12.8 ± 2.3 (43)[x] | 12.9 ± 1.6 (35)[x] | 12.2 ± 2.2 (42)[x] | 1.14 | 0.32 |
| Overall food safety[c] | 44.7 ± 5.9 (43)[x,y] | 45.8 ± 4.3 (35)[x] | 42.5 ± 5.6 (39)[y] | 3.61 | 0.03 |

n=140; due to non-respondces n does not equal 140

[a]The highest possible score is 6.

[b]The highest possible score is 18.

[c]The highest possible score is 60, which is a composite of the above four concepts.

[d]Results from Analysis of Variance (ANOVA)

Note: Means having the same superscript (x, y series) are not statistically significantly different by Hochberg post hoc analysis, $P \leq 0.05$

The food safety knowledge scores based on educational attainment were evaluated, and ANOVA revealed differences (Table 7). Generally, mature adults with an eighth grade education scored lowest in all constructs and *overall*, and those with an advanced college degree achieved the highest *overall* food safety score. Statistically significant differences were identified in the *hand washing* ($P \leq 0.05$) and *food handling* ($P \leq 0.04$) constructs, as well as in *overall* food safety knowledge ($P \leq 0.03$). Hochberg's GT2 post hoc analysis of the *hand washing* data did not identify any differences between educational attainment groups even though $P = 0.05$ is generally considered significant. In the *food handling* construct, Hochberg's GT2 post hoc analysis identified a difference existed between mature adults with an eighth grade education and those graduating high school or college. The statistically significant difference in *overall* food safety knowledge occurred between mature adults with an eighth grade education and those with a high school diploma or advanced college degree.

**Table 7. Food Safety Knowledge Scores by Education**

| | Mean Score ± SD (n) | | | | | |
|---|---|---|---|---|---|---|
| ***Dependent Variable:*** | ***Graduated 8th grade*** | ***Graduated high school*** | ***College Degree*** | ***Advanced degree*** | ***F =***[d] | ***P =*** |
| FBI Symptoms[a] | 2.5 ± 2.4 (4)[x] | 4.1 ± 1.8 (83)[x] | 4.8 ± 1.6 (26)[x] | 4.7 ± 1.5 (13)[x] | *2.61* | *0.06* |
| Handwashing[b] | 11.8 ± 4.6 (4)[x] | 14.1 ± 2.2 (83)[x] | 13.5 ± 2.3 (26)[x] | 15.2 ± 2.7 (13)[x] | 2.77 | 0.05 |
| Food handling[b] | 11.0 ± 2.7 (5)[x] | 13.6 ± 2.1 (84)[y] | 13.7 ± 1.8 (25)[y] | 13.8 ± 1.3 (13)[x,y] | 2.77 | 0.04 |
| Food preparation[b] | 12.2 ± 1.6 (5)[x] | 12.8 ±2.2 (79)[x] | 12.4 ± 1.9 (25)[x] | 12.9 ± 1.3 (13)[x] | 0.31 | 0.82 |
| Overall food safety[c] | 37.5 ± 7.5 (4)[x] | 44.6 ± 5.5 (78)[y] | 44.3 ± 4.3 (25)[x] | 46.6 ± 3.4 (13)[y] | 3.24 | 0.03 |

n=140; due to non-respondces n does not equal 140

[a]The highest possible score is 6.

[b]The highest possible score is 18.

[c]The highest possible score is 60, which is a composite of the above four concepts.

[d]Results from Analysis of Variance (ANOVA)

Note: Means having the same superscript (x, y series) are not statistically significantly different by Hochberg post hoc analysis, P ≤ 0.05

## *Research Question Two: Mature Kansans' Food Safety Concerns While Eating Away From Home*

The second research question evaluated whether mature Kansans' food safety knowledge correlated with their food safety concerns while eating away from home. In other words, as food safety knowledge increased did food safety concerns while eating away from home also increase? Overall, participants reported their greatest food safety concern pertained to commercial operations; the mean rating was 2.9 ± 1.3 on a five-point scale (0 = no concern and 4 = significant concern) (Table 8). Sixty (42.9%) participants cited having "*significant concern*" regarding commercial operations. Fewer participants reported "*significant concern"* in home settings (n=28, 20%) and community-based meal sites (n=43, 30.7%). In contrast, some respondents had "*no concern"* regarding food safety in commercial operations (n=9, 6.4%), residential settings (n= 45, 32.1%), and community-based meal sites (n=19, 13.6%)

**Table 8. Concerns While Eating Away from Home**

| | Mean ± SD | n | No Concern (n) | % | Almost no concern (n) | % | Some concern (n) | % | Great concern (n) | % | Significant concern (n) | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rate Your Concern Regarding Food Safety in:** | | | | | | | | | | | | |
| commercial operation | 2.9 ± 1.3 | 129 | 9 | 6.4 | 9 | 6.4 | 27 | 19.3 | 24 | 17.1 | 60 | 42.9 |
| residential kitchen | 1.7 ± 1.6 | 117 | 45 | 32.1 | 11 | 7.9 | 24 | 17.1 | 9 | 6.4 | 28 | 20.0 |
| community based meal site kitchen | 2.6 ± 1.5 | 109 | 19 | 13.6 | 7 | 5.0 | 18 | 12.9 | 22 | 15.7 | 43 | 30.7 |
| **Food Safety Concerns While Eating Out:** | | | | | | | | | | | | |
| servers and cooks not washing their hands | 3.4 ± 1.0 | 128 | 3 | 2.1 | 6 | 4.3 | 10 | 7.1 | 24 | 17.1 | 85 | 60.7 |
| general cleanliness of the staff | 3.4 ± 1.0 | 128 | 3 | 2.1 | 6 | 4.3 | 12 | 8.6 | 20 | 14.3 | 87 | 62.1 |
| workers that are ill | 3.6 ± 1.0 | 128 | 3 | 2.1 | 7 | 5.0 | 4 | 2.9 | 11 | 7.9 | 103 | 73.6 |
| not cooking hamburgers to proper temperature | 3.3 ± 1.1 | 126 | 6 | 4.3 | 6 | 4.3 | 12 | 8.6 | 22 | 15.7 | 80 | 57.1 |
| not cooking eggs until yolks and whites are firm | 3.0 ± 1.3 | 125 | 9 | 6.4 | 14 | 10.0 | 14 | 10.0 | 25 | 17.9 | 63 | 45.0 |
| overall cleanliness of the operation | 3.6 ± 0.8 | 125 | 2 | 1.4 | 3 | 2.1 | 8 | 5.7 | 19 | 13.6 | 93 | 66.4 |
| not washing produce thoroughly | 3.4 ±1.0 | 123 | 4 | 2.9 | 5 | 3.6 | 10 | 7.1 | 21 | 15.0 | 83 | 59.3 |
| not washing hands between raw and cooked foods | 3.6 ± 0.8 | 127 | 1 | 0.7 | 4 | 2.9 | 9 | 6.4 | 13 | 9.3 | 100 | 71.4 |
| not holding cold foods at proper temperatures | 3.5 ± 1.0 | 124 | 3 | 2.1 | 4 | 2.9 | 10 | 7.1 | 23 | 16.4 | 84 | 60.0 |
| not holding hot foods at proper temperatures | 3.5 ± 0.9 | 124 | 3 | 2.1 | 3 | 2.1 | 10 | 7.1 | 22 | 15.7 | 86 | 61.4 |

n=140; due to non-respondents totals may not equal 140 or 100%
The scale was no concern=0 and significant concern=4

Additional information revealed the top three food safety violations with "*significant concerns*" were: workers that were ill (73.6%), employees not washing hands between preparing raw and cooked foods (71.4%), and overall cleanliness of the operation (66.4%). In contrast, the three items that had the highest percentage of "*no concern*" were not cooking eggs until yolks and whites are firm (6.4%), not cooking hamburgers to proper internal temperature (4.3%), and not washing produce thoroughly (2.9%). This information regarding participants' food safety concerns provided information to answer the second research question. The mean concern rating and food safety knowledge scores (in each construct and overall) were analyzed utilizing a Pearson's correlation (Table 9). The results from a Pearson's correlation indicated that food safety knowledge and concerns while eating away from home were not related.

**Table 9. Correlations Between Food Safety Knowledge Scores and Food Safety Concerns**

| *Preparation Site:* | *Hand Washing* | *P* | *Food Handling* | *P* | *Food Preparation* | *P* | *Overall Food Safety* | *P* |
|---|---|---|---|---|---|---|---|---|
| Commercial | 0.01 | 0.28 | 0.04 | 0.63 | 0.03 | 0.78 | 0.06 | 0.55 |
| Residential* | 0.15 | 0.10 | 0.13 | 0.16 | -0.03 | 0.73 | -0.02 | 0.83 |
| Community Meal Site | 0.03 | 0.76 | 0.06 | 0.54 | 0.07 | 0.51 | 0.04 | 0.72 |

n=140
*Residential: friend's or family's home

## Discussion

This research project sought to gain insight of mature Kansans food safety knowledge in *handwashing, food handling, food preparation,* and *symptoms of foodborne illness* constructs, as well as evaluating their food safety concerns while eating away from home. In addition, this research aimed to compare the food safety knowledge of mature Kansans based on age, gender, educational attainment, and geographic location. Last, the relationship between food safety knowledge and concerns while eating away from home were evaluated. This section will present an interpretation of the results, state the limitations, and recommendations for future research.

Limited research has been completed examining the food safety knowledge of community-based mature adults aged 65 years and older, and virtually no studies have targeted those aged 55-64 years. Therefore, little is known about the food safety knowledge of the mature adult population. In the present study, mature adults reported having sufficient food safety knowledge. In fact, 12 of the 60 responses were correctly identified ≥ 90%; however, 19 of the 60 responses were correctly identified < 70% of the time. These 19 responses measured participants' knowledge of proper hand drying techniques, food and refrigerator temperatures, melon preparation, surface cleaning, left over storage, cooking techniques, and thawing practices. Previous researchers have identified several of these same items; but, this study indicates two new areas lack sufficient knowledge[4-7]. First, this study revealed that proper hand drying techniques are not commonly recognized. Almost 40% of the respondents agreed a dish towel was an appropriate hand drying technique; yet, it is not. Dish towels may harbor bacteria and are easily contaminated without the individual knowing. Drying hands using a hand dryer or air-drying are acceptable practices. Yet, only 47.9% of participants agreed with the use of air hand dryers, and 5.7% recognized air-drying as appropriate. The second area needing additional attention addresses the preparation of melons before cutting; only 24.3% of participants understood how to properly wash melons. To increase consumer awareness, educational programs should stress appropriate hand drying techniques and melon preparation.

This project compared the food safety knowledge of mature adults based on age, gender, geographic location, and educational attainment by analyzing the responses to ten food safety knowledge questions. Few studies have compared knowledge based on these variables. One study completed by Sellers, et al. in 2006 reported that younger mature adults (age not identified in study) had more food safety knowledge than the older group[8]. This research echoed these

findings. Interestingly, significant differences in knowledge were not observed in *hand washing, food handling, food preparation,* or *foodborne illness symptom*; yet, a difference was observed in *overall* food safety knowledge. The reason a statistically significant difference exists in the *overall* knowledge and not the individual constructs is due to the size of the standard deviation. The size of the standard deviation compared to the mean is greater for the individual constructs than the standard deviation of the *overall* score. The older group's lack of food safety knowledge may be attributed to their lack of correct food safety knowledge or willingness to change long-standing habits.

Another facet, which has not previously been reported, contrasted the food safety knowledge between genders. Women correctly answered statistically significantly more *food handling* questions than the men. The cause for the difference between men and women's *food handling* knowledge is unclear, but may be attributed to experience in the kitchen. The cause for the difference is unclear, but may be related to the food handling experiences of men and women from this generation. Men typically worked outside of the home and were not faced with the food safety challenges associated with food handling and preparation, which would limit their knowledge.

Other findings concluded there was a difference in food safety knowledge between the districts, which cannot be fully explained. District 2 had more participants (n = 90) than District 1 (n = 50), and further evaluation of the demographics between the districts revealed a variation in the demographics of the sample. Respondents from District 1 had a higher percent of men and eighth grade graduates, which were associated with lower food safety knowledge scores.

The last knowledge comparison was based on educational attainment. Previous research has concluded that higher education was associated with negative food safety attitudes, lower perception of risk, and poor food safety behaviors; yet, the results of this research indicated that mature adults with advanced degrees had the greatest food safety knowledge[4]. Statistically significant differences were observed in the *food handling* construct, as well as in *overall* food safety. Generally, individuals with an eighth grade education had the lowest food safety score in all constructs, followed by participants with a college degree, a high school diploma, and those with an advanced college degree. These findings indicated that mature adults with an eighth grade education had statistically significantly less food safety knowledge than other groups or a confounding factor is present such as low literacy or test anxiety. However, the eighth grade

sample size was small and may not be truly representative of the population, so extrapolation of findings is not possible.

In addition, this study ascertained information regarding participants' food safety concerns in three food preparation sites outside of the home. The goal was to identify whether a relationship existed between food safety knowledge and food safety concerns while eating away from home. Based on a review of the literature, this is the first research examining this relationship. . It was hypothesized that a positive correlation would be observed between food safety knowledge and food safety concerns. The results of the Pearson's correlation did not confirm a relationship between food safety knowledge and food safety concerns while eating away from home. All correlations were very close to zero, which indicates no relationship. There is not a clear indication why food safety concerns did not increase with food safety knowledge; however, it is plausible that mature adults are not aware of the number of food handling errors that may occur in food preparation sites outside the home. Additionally, mature adults may not fully recognize the health related consequences associated with foodborne illnesses.

### *Limitations*

Limitations to this study exist. First, the sample size was small, and a larger sample size would increase the statistical power. Next, the sample represented only urban Kansans, which may not allow extrapolation of findings to other mature adult groups. Additionally, the information was gathered from a convenience sample and the information was self-reported. Nevertheless, this study provides valuable information to the growing body of scientific literature concerning food safety in the mature adult population.

### *Recommendations*

Further investigation of mature adults' food safety knowledge, practices, barriers, and concerns, as well as further investigation into mature adults' food safety knowledge while eating away from home will be important. Continued research is crucial due to the rapidly growing mature adult population, their higher susceptibility for foodborne illness, and the increased consumption of foods away from home. Further research will add credibility to the existing food safety knowledge literature and direct food safety educators to relevant topics.

## Conclusions

The conclusions drawn from the data analyses were:

1. Overall, most mature adults had adequate food safety knowledge; however, some food safety concepts need attention. These concepts include proper hand-drying techniques, food and refrigerator temperatures, melon preparation, surface cleaning, left over storage, cooking techniques, and thawing practices.
2. Gender and age had little association with food safety knowledge.
3. Education had a moderate association with food safety knowledge.
4. Geographic location had the greatest association with food safety knowledge.
5. A measurable relationship between food safety knowledge and food safety concerns while eating away from home did not exist.

Aside from the conclusions drawn from the data analysis, other conclusions were drawn that may have affected the interpretation of the findings. First, the questionnaire may not have accurately recorded mature adults knowledge. One question in particular, measuring mature adults' food temperature knowledge, may have led to false assumptions. The question asked participants to identify the correct statements, so participants not knowing the answers may have not circled any. Data analysis would indicate that by chance alone three of the six responses should have been correct, since three of the statements were false. During data analysis, this problem became evident since 98.6% of the respondents correctly identified the correct cooking temperature of casseroles; yet, only 28% and 61% could identify the correct end-point temperatures of ground meat and chicken respectively.

Additionally, other confounding variables may have affected the statistical interpretation of the data. Confounding variables that were not adjusted for include low literacy level, test anxiety, and lack of food safety experience.

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# CHAPTER 4 - The Relationship Between Mature Kansans' Food Safety Knowledge and Selected Variables


## Abstract

Foodborne illness is a serious health problem in the United States, and especially in the mature adult population. This research examined food safety knowledge of mature Kansans (aged 55years and older) in four important constructs (*handwashing, food handling, food preparation, and foodborne illness symptoms*), as well as their food safety concerns while eating away from home. One-hundred and forty participants completed a self-administered questionnaire containing ten food safety knowledge questions representing sixty answer options. Replies to those questions were compared by age, gender, geographic location, and educational attainment. Results indicated that geographic location was statistically significantly related to food safety knowledge; however, age, gender, and education had little to moderate association. Additional findings revealed food safety knowledge was not associated with participants' level of food safety concerns while eating away from home. In conclusion, the findings revealed that mature Kansans possessed general food safety knowledge; however, some responses indicated mature adults did not fully understand certain food safety guidelines. Areas identified as needing further attention included appropriate hand drying and surface cleaning, safe food and refrigerator temperatures, proper thawing practices, as well as safe leftover and melon preparation.



**Keywords:** mature adults, seniors, older adults, food safety knowledge, Kansans, foodborne illness


## Introduction

Illnesses associated with improperly handled food presents a significant health problem in the United States (U.S.) today. The Centers for Disease Control and Prevention (CDC) estimated that foodborne illness affects 76 million Americans every year, with 325,000 hospitalizations and 5,000 deaths attributed to foodborne illness annually[1]. Foods consumed in the home, as well as away from home contribute to the high incidence of foodborne illness. In addition, some populations are at an increased risk for acquiring foodborne illness—the young, the old, and those with compromised immune systems. Several characteristics of mature adults

contribute to their increased susceptibly: (1) changes in the body due to aging, including immunological changes; (2) declining health due to the presence of chronic illnesses (e.g., cardiovascular disease, cancer, *et cetera*); (3) adverse side effects of medications; and (4) incomplete knowledge of current food safety recommendations[2-4]. As the mature adult population continues to increase in the U.S., this problem will likely worsen.

A small volume of the food safety literature is devoted to the mature adult population; therefore, few facts are known about this population. The existing literature does reveal that mature adults possess food safety knowledge; however, their knowledge and practices while in the home vary greatly[3-5]. Specific concerns identified by previous researchers are related to practices of handwashing, food handling, and food preparation[3-6]. Mature adults have reported not washing their hands prior to eating or at appropriate times during food preparation[5, 6]. Food handling errors reported include food stored at too warm of temperatures and foods improperly thawed and cooked[3, 7, 8]. Mature adults lack knowledge of several safe food preparation practices, and errors are reported during cooking including cross-contamination and not measuring end-point cooking temperatures[3-6, 9].

Foodborne illness can be acquired outside of the home, and according to the Centers for Disease Control and Prevention (CDC) and the Tennessee Department of Health; 52-59% of reported foodborne illnesses are associated with commercial operations[10, 11]. In recent years, the number of meals prepared by commercial operations has grown significantly. The National Restaurant Association projects restaurants will provide 130 million meals a day, which will total over 70 billion meals in 2009[12]. Today almost 50% of the family food dollar is spent in commercial operations, and in 2009, restaurant sales are expected to exceed 566 billion dollars[12]. Mature adults are a part of this changing food environment, and have increased their spending by 33% in commercial operations over a four-year period[13]. This is noteworthy since restaurants contribute significantly to the incidence of foodborne illness, and mature adults are frequently eating away from home.

## Methods

This study targeted community-based English speaking Kansans aged 55 years and older in two Area Agency on Aging districts in the state of Kansas. Almost one-fourth of mature Kansans reside in these two districts. A convenience sample (n=140) was recruited from various

organizations including senior centers, community college groups, and programs suggested by Cooperative Extension personnel or others working with the target population. Participant information was ascertained through a self-administered questionnaire, which was developed and tested by the funding grant following an elicitation study. Ten multiple-response questions representing sixty answer options evaluated the participants' knowledge of food safety in four constructs—*hand washing*, *food handling*, *food preparation,* and *foodborne illness symptoms*. The *foodborne illness symptom* question evaluated mature Kansans knowledge of symptoms most commonly associated with foodborne illnesses. Questions also ascertained mature adults' knowledge of when they felt handwashing should occur, the necessary supplies, and appropriate hand drying techniques. *Food handling* questions concentrated on the preparation of produce, instances of cross-contamination, and the storage of leftovers. The final construct, *food preparation,* focused on appropriate food cooking, thawing, and cooked food temperatures. An additional question ascertained participants' level of food safety concerns in commercial operations, community-based meal sites, and other residential settings such as the home of friends or family. Participants rated their food safety concerns in each preparation site on a zero (no concern) to four (significant concern) scale. Additionally, participants provided demographic information such as age, gender, and educational attainment.

Once the data collection was completed, the information was entered into Statistical Program for the Social Sciences (SPSS), and evaluated. Descriptive statistics, frequencies, means, and standard deviations provided insight into mature adults' food safety knowledge and concerns. Independent t-tests and analysis of variance (ANOVA) provided further analyses regarding the relationship between mature Kansans' food safety knowledge and the variables of age, gender, educational attainment, and geographic location. ANOVA post hoc analysis was performed by Hochberg's GT2 pairwise test, which was appropriate for unequal sample sizes with equal variances. Additionally, Pearson's correlation determined whether an association existed between food safety knowledge and food safety concerns. Results were considered statistically significant at a $P \leq 0.05$. Additionally, food safety knowledge was determined to be adequate if the correct response rates were $\geq 70\%$.

# Results

## *Demographics*

Respondents represented a predominately white, female population ranging in age from 56 to 94 years with a mean of 71.6 ± 10.0. The sample was comprised of 35.2% men and 64.8% women, which is closer to the actual American population (45% and 55% respectively in 2008) than previous studies[14]. The majority (66%) had a high school diploma followed by those receiving a college degree, an advanced college degree, and an eighth grade education. District 1 (Leavenworth and Wyandotte counties) and District 2 (Butler, Harvey, and Sedgwick counties) represented 35.7% and 64.3% of the sample respectively. The participants from each district differed in mean age, gender, and educational attainment; District 1 had a greater percentage of males and participants achieving an eighth grade education. One-hundred and forty food safety questionnaires were completed; however, responses to individual questions varied due to incomplete or missing replies.

## *Food Safety Knowledge*

Participants scored the highest on the *handwashing* construct (76.8% ± 0.1) followed by *food handling* (74.2% ± 0.1) and *food preparation* (70.0% ± 0.1). Overall, participants correctly identified 73.3% ± 0.1 of the sixty food safety responses. In fact, 12 of the 60 responses were correctly identified ≥ 90%; however, 19 of the 60 responses were correctly identified < 70% of the time. These 19 responses measured participants' knowledge of proper hand-drying techniques, food and refrigerator temperatures, melon preparation, surface cleaning, left over storage, cooking techniques, and thawing practices. Further investigation compared mature adults' food safety knowledge by age, gender, educational attainment, and geographic location. Independent t-tests identified differences existed between groups based on gender and geographical location. Women correctly answered more questions than men, however, statistically significant differences were only noted in the *food handling* construct. Differences in food safety knowledge were noted between the two geographic locations. Respondents in District 2 possessed statistically significant more *handwashing* and *food handling* knowledge, as well as achieving statistically significantly higher *overall* food safety scores.

Further investigation using ANOVA compared participants' food safety knowledge by age and educational attainment. Age was divided into three categories: 55-65, 66-75, and 76

and older. Statistically significant differences by age existed only while comparing the *overall* food safety knowledge; no statistically significant differences were observed in the individual constructs. Post hoc analysis indicated the difference in *overall* knowledge existed between participants aged 66-75 years old and those 76 years and older; and mature adults aged 66-75 years old correctly answered more of the questions.

Several differences were observed while evaluating the relationships between level of attained education and food safety knowledge. Participants reported their level of educational achievement as eight grade diploma, high school diploma, college degree, or advanced college degree. In all four constructs, participants with an eighth grade education scored lowest. Mature adults with an eighth grade education had statistically significantly less *food handling* knowledge than those with a high school degree or a college degree, and their *overall* knowledge was statistically significantly lower than those with a high school degree or an advanced college degree.

### *Relationship Between Food Safety Knowledge and Concerns*

The last variable evaluated participants' food safety concerns regarding foods prepared away from home (commercial operations, community-based meal sites, and other residential settings). A Pearson's correlation compared participants' mean food safety concerns away from home with mean scores for *hand washing*, *food handling*, *food preparation*, and *overall* food safety knowledge. The results indicated that no statistically significant relationship between food safety knowledge and concerns existed for this group of mature adults.

## Discussion

The findings from this study support previous conclusions regarding overall food safety knowledge of mature adults[4]. In the present study, mature adults reported having sufficient food safety knowledge since the group's *overall* food safety knowledge score was > 70%. Participants lacked food safety knowledge in the following areas: cooking temperatures, hand drying techniques, melon preparation, leftover storage, and cleaning and thawing practices. Previously researchers have identified that cooking temperatures are not typically known, and this study echoed these findings[3-6, 8, 9]. The findings regarding cooling and thawing knowledge are in concert with Gettings, et al., who concluded that a high percent of participants did not properly cool or thaw foods[3]. These findings indicate food safety education should emphasize

the relationship between improperly thawing, cooking, and cooling foods and increased risk of foodborne illness.

Two findings from this study needing further attention have not been reported previously. Only 24.3% of the participants could correctly identify the proper technique to clean melons, which is unacceptable. Another new finding revealed that participants did not commonly recognize proper hand drying techniques. Almost 40% of the respondents agreed that using a dish towel was an appropriate drying technique; yet, it is not. Dish towels can be contaminated with pathogens during cooking and may harbor bacteria that can be further spread throughout the kitchen. Drying hands using a hand dryer or air-drying are acceptable practices. Yet, only 47.9% of participants agreed with the use of hand dryers and 5.7% recognized air-drying as appropriate. Again, consumer educational programs should stress the importance of appropriate hand drying to reduce the incidence of foodborne illness.

Additionally, this study compared the knowledge of mature Kansans based on age, gender, educational attainment, and geographic location. Few studies have compared knowledge based on these variables. One study completed by Sellers, et al. reported that younger mature adults (younger age not defined) reported more safe food handling practices prior to a food safety intervention than an older group[5]. The present study found similar results regarding knowledge. The older group's lack of food safety knowledge may be attributed to their lack of correct food safety knowledge or willingness to change long-standing habits. Another finding, which has not previously been reported, contrasted the food safety knowledge between the genders. A statistically significant difference was observed by gender; women correctly answered more *food handling* questions than the men. The cause for the difference is unclear, but may be related to the food handling experiences of men and women from this generation. Men typically worked outside of the home and were not faced with the food safety challenges associated with food handling and preparation, which would limit their knowledge.

A comparison of food safety knowledge based on educational attainment indicated a relationship existed between these two variables. Previous research concluded that higher education was associated with negative food safety attitudes, lower perception of risk, and poor food safety behaviors; yet, the results of this project indicate that mature adults with advanced degrees have the greatest food safety knowledge[4]. Generally, individuals with an eighth grade education had the lowest food safety score in all constructs, followed by participants with a

college degree, a high school diploma, and those with an advanced college degree. These findings indicated that mature adults with an eighth grade education had statistically significantly less food safety knowledge than other groups or a confounding factor is present such as low literacy or test anxiety. However, the eighth grade sample size was small and may not be truly representative of the population, so extrapolation of findings is not possible.

Other findings revealed there was a statistically significant difference in food safety knowledge between the two districts; District 2 scored highest in all constructs. This cannot be fully explained from the information collected, but may be due to variations in gender, education, and age of the sample. Respondents from District 1 had a higher percent of men and eighth grade graduates, which were associated with lower food safety knowledge scores.

In addition, this study ascertained information regarding participants' food safety concerns in three food preparation sites outside of the home. The goal was to identify whether a relationship existed between food safety knowledge and food safety concerns while eating away from home. Based on a review of the literature, this is the first research examining this relationship. It was hypothesized that a positive correlation would be observed between food safety knowledge and food safety concerns. The results of the Pearson's correlation did not confirm a relationship between food safety knowledge and food safety concerns while eating away from home. All correlations were very close to zero, which indicates no relationship. There is not a clear indication why food safety concerns did not increase with food safety knowledge; however, it is plausible that mature adults are not aware of the number of food handling errors that may occur in food preparation sites outside the home and the health related consequences associated with foodborne illnesses.

There are limitations to this study, as with all studies. First, the sample size was small, and a larger sample size would increase the statistical power. The sample represented only urban Kansans, so extrapolation of findings to other mature adult groups is not possible. Additionally, the information was gathered from a convenience sample, and the information was self-reported. Nonetheless, this study provides valuable information and adds to the growing body of scientific literature concerning food safety in the mature adult population.

Further investigation of mature adults' food safety knowledge, practices, barriers, and concerns, as well as further investigation into mature adults' food safety knowledge while eating away from home will be important. Continued research is crucial due to the rapidly growing

mature adult population, their higher susceptibility for foodborne illness, and the increased consumption of foods away from home. Further research will add credibility to the existing food safety knowledge literature and direct food safety educators to relevant topics.

## Conclusions

The conclusions drawn from the data analyses were:

1. Overall, most mature adults had adequate food safety knowledge; however, some food safety concepts need attention. These concepts include proper hand-drying techniques, food and refrigerator temperatures, melon preparation, surface cleaning, left over storage, cooking techniques, and thawing practices.
2. Gender and age had little association with food safety knowledge.
3. Education had a moderate association with food safety knowledge.
4. Geographic location had the greatest association with food safety knowledge.
5. A measurable relationship between food safety knowledge and food safety concerns while eating away from home did not exist.

Aside from the conclusions drawn from the data analysis, other conclusions were drawn that may have affected the interpretation of the findings. First, the questionnaire may not have accurately recorded mature adults knowledge. One question in particular, measuring mature adults' food temperature knowledge, may have led to false assumptions. The question asked participants to identify the correct statements, so participants not knowing the answers may have not circled any. Data analysis would indicate that by chance alone three of the six responses should have been correct, since three of the statements were false. During data analysis, this problem became evident since 98.6% of the respondents correctly identified the correct cooking temperature of casseroles; yet, only 28% and 61% could identify the correct end-point temperatures of ground meat and chicken respectively.

Additionally, other confounding variables may have affected the statistical interpretation of the data. Confounding variables that were not adjusted for include low literacy level, test anxiety, and lack of food safety experience.

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# Appendix A - **Institutional Review Board Approval Letter**

9/25

University Research
Compliance Office
203 Fairchild Hall
Lower Mezzanine
Manhattan, KS 66506-1103
785-532-3224
Fax: 785-532-3278
http://www.ksu.edu/research/comply

TO: Valentina Remig
Human Nutrition
206 Justin Hall

Proposal Number: 4356

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: July 11, 2007

RE: Proposal Entitled, "Multimedia Food Safety Training Program for Community Based Older Adults"

The Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is exempt from further review.

This exemption applies only to the proposal currently on file with the IRB. Any change affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Exemption from review does not release the investigator from statutory responsibility for obtaining the informed consent of subjects or their authorized representatives, as appropriate, either orally or in writing, prior to involving the subjects in research. The general requirements for informed consent and for its documentation are set forth in the Federal Policy for the Protection of Human Subjects, 45 CFR 46.116-117, copies of which are available in the University Research Compliance Office and online at http://ohrp.osophs.dhhs.gov/humansubjects/guidance/45cfr46.htm#46.116. In cases of remote oral data collection, as in telephone interviews, oral consent is sufficient and the researcher is required to provide the respondent with a copy of the consent statement only if the respondent requests one. The researcher must, however, ask the respondent whether he or she wishes to have a copy. The initiative in requesting a copy must not be left to the respondent. Regardless of whether the informed consent is written or oral, the investigator must keep a written record of the informed consent statement, not merely of the fact that it was presented, and must save this documentation for 3 years after completing the research.

The identification of a human subject in any publication constitutes an invasion of privacy and requires a separate informed consent.

Injuries or any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

# Appendix B - **Research Abstract Sent to Sites**

**Brief Abstract**
**Food Safety Education**
**Kansas State University**
**Department of Human Nutrition**
**Manhattan, KS**

Over the past decade, foods consumed in the home have contributed to approximately 87% of reported foodborne outbreaks in the U.S., United Kingdom, Europe, Australia, New Zealand, and Canada. Yet, research shows that consumers do not think it is common for people in the U.S. to become sick due to food handling practices in the home.

The goal of this project is to develop a multimedia food safety education program, specifically targeting mature community-based Kansans (55+ years of age), who prepare at least some of their own meals. Specific objectives are to: 1) Identify an effective means of educating older adults using their preferred technology and language as the training source; 2) Compare food safety knowledge, attitudes, and practices of older adults; and 3) Develop and test English and companion Spanish versions of a multimedia educational program to increase older adults' food safety knowledge and improve practices.

Appendix C - **Flyer for Recruitment Sites**

# *Volunteers Needed*

## Food Safety Education

Kansas State University
Department of Human Nutrition

**Date**

**Time.**

## Location

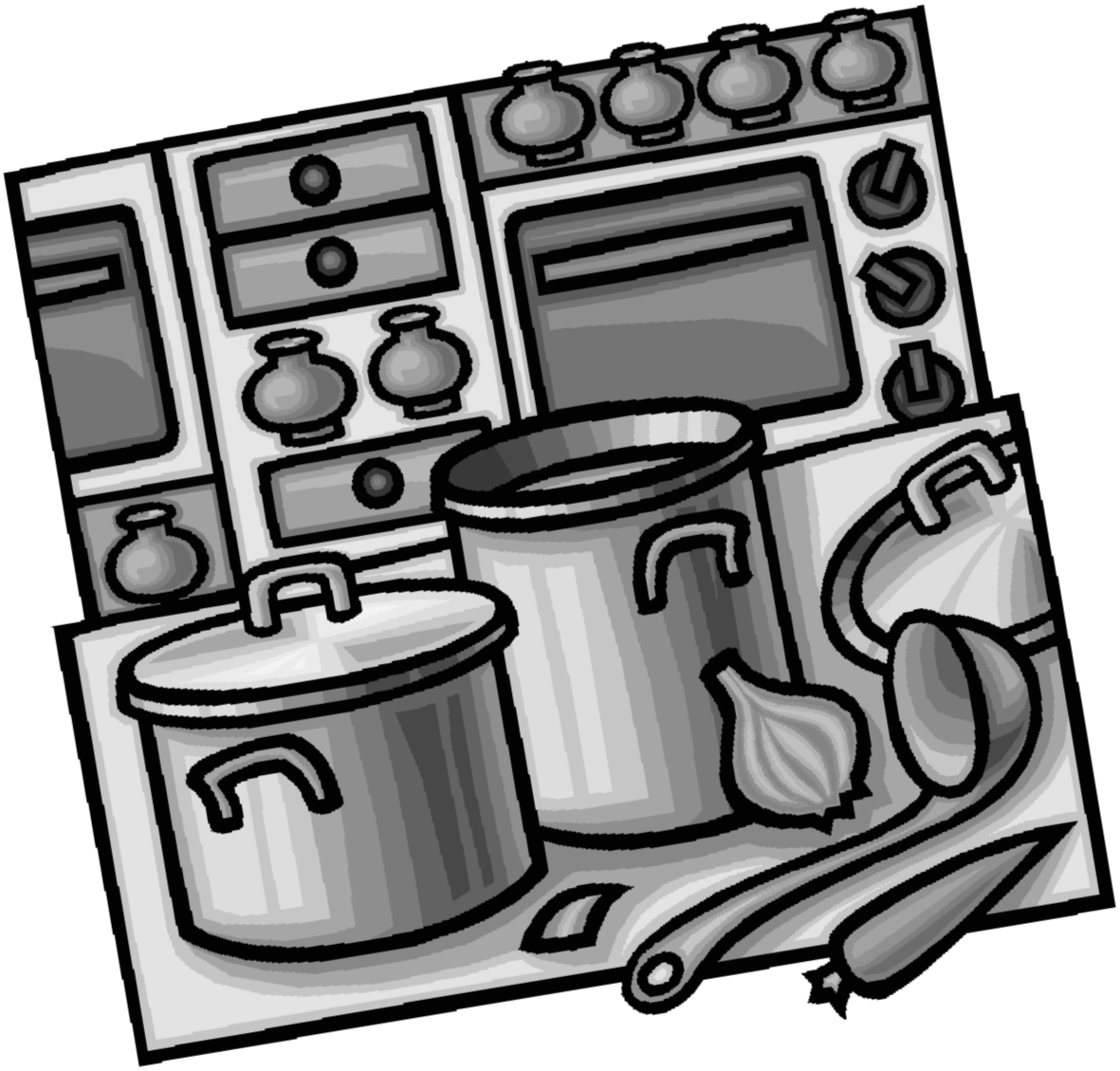
Each person, 55 years or older, will be asked to fill out a 30-40 minute questionnaire investigating their current food safety habits and computer usage. A prize will be given to each person completing the questionnaire.

**For more information:**

785-532-2206

# Appendix D - **Food Safety Education and Technology Survey**

# Food Safety Education & Technology Survey



**Department of Human Nutrition**
**Kansas State University**
**Manhattan, KS 66506**

Dear Study Participant:

Foods consumed in the home contribute to a majority of foodborne outbreaks in the U.S. Older adults (60+ years of age) are at increased risk for foodborne illness, are more likely to become seriously ill from complications, and are the fastest growing segment of the U.S. Most consumers and older adults incorrectly believe the past food handling practices are not harmful if illness was not recognized.

We are conducting this study to explore the knowledge, attitudes, and behaviors related to safe food handling practices of mature adults across Kansas. It is understood that by completing the survey that follows, you are consenting to be in this research study, "Multimedia Food Safety Training for Community Based Older Adults". Using results from this study, a food safety education program will be developed specifically to address the needs and learning styles of older adults. Your participation is completely voluntary and you may discontinue at any time without any penalty. Individual responses will not be identifiable and all results will be reported as group data. It may take approximately 40 minutes to complete all questions.

**Your response is very important to the success of this study**. We greatly appreciate your time and assistance. Should you any questions about the study, please contact Dr. Valentina Remig at (785) 532-0172. If you have any questions about the rights of individuals in this study or about the way it is conducted, you may contact the University Research Compliance Office at (785) 532-3224. Thank you for your help.

Cordially,


Valentina M. Remig, PhD, RD
Assistant Professor
Department of Human Nutrition

Kevin R. Roberts, PhD
Assistant Professor
Department of Hospitality Management & Dietetics

Gerry Snyder, MS
Multimedia Specialist
Department of Communications

Toni Bryant, MS
Coordinator, Fort Riley
Kansas State Research and Extension

For office use only:

ID#: _____

## Section I: Food Safety Knowledge

**Please circle ALL** that apply for the given question.

1. Which are symptoms of foodborne illnesses?

A. Diarrhea
B. Vomiting
C. Dizziness
D. Nausea
E. Fever
F. Headache

2. In your opinion, to safely prepare food when should you wash your hands?

A. Before eating
B. Before handling foods
C. After playing with pets
D. After handling raw meat
E. After using the toilet or changing diapers
F. If my hands look dirty

3. Which of the following do you think are necessary for proper hand washing?

A. Cold water
B. Hand sanitizer
C. Soap
D. 20 seconds of scrubbing hands
E. Warm water
F. 15 seconds of scrubbing hands

4. How do you think you should dry your hands after washing?

A. With a dish/hand towel
B. With a blow dryer
C. With a clean paper towel
D. On my apron
E. By shaking my hands
F. On my clothing

5. In your opinion, what should you do to fresh fruits and vegetables before you eat or cook them?

A. Wipe them gently with a clean paper towel
B. Rinse them under running water
C. Scrub firm skinned fruits and vegetables with a brush under running water
D. Use a fruit and vegetable cleaning solution (such as Fit®)
E. Use a mild bleach solution t clean whole fruit and vegetables
F. Scrub melons with a mild soap and water

6. How do you think you can prevent cross-contamination?

A. Wash cutting boards with hot soapy water after preparing each food item
B. Dry cutting boards thoroughly after each use
C. Use a sponge to thoroughly clean counter tops
D. Keep raw meat above fruits and vegetables in the refrigerator
E. Never store cooked meat on an unwashed plate that held raw meat
F. Only clean surfaces when they look dirty

7. In your opinion, which of the following are proper ways to handle leftovers?

A. Leave leftovers on the counter as long as they have been thoroughly cooked
B. Always refrigerate leftovers from a restaurant within four hours of getting home
C. Store leftovers in big containers
D. Use a refrigerator thermometer to be sure that your refrigerator is colder than 41ºF
E. Always eat or discard leftovers within one week
F. Refrigerate leftovers within two hours of food preparation

8. How do you think you should check to assure that food is thoroughly cooked?

A. Look at it to make sure it is the right color
B. Touch it to see that it is hot enough
C. Make sure it has been cooking for the correct amount of time
D. Taste it to see if it tastes right
E. Look at the center of the food not just the surface of the food
F. Use a food thermometer

9. In your opinion, how should you defrost frozen food?

A. At room temperature (counter top, table top, in a cold oven, or in a covered dish)
B. In the refrigerator
C. In cold or hot standing water and cook immediately
D. Under cold running water
E. In the microwave and cook immediately
F. In a cold part of the house

10. Which of the following temperatures do you think are correct for food preparation?

A. Cold food is held below 41ºF
B. Hot food is held above 140ºF
C. Leftover foods should be reheated to 160ºF
D. Ground beef should be cooked to 150ºF
E. Chicken should be cooked to 165ºF
F. Casseroles should be cooked to 170ºF

## Section II: Food Safety Practices

**Please circle the number** that represents what you do now; circling 0 means you "never do" and 4 means you "always do".

| 11. I wash my hands with soap and water . . . | Never | | | | Always |
|---|---|---|---|---|---|
| before eating | 0 | 1 | 2 | 3 | 4 |
| before handling any foods | 0 | 1 | 2 | 3 | 4 |
| after playing with pets | 0 | 1 | 2 | 3 | 4 |
| after handling raw meat | 0 | 1 | 2 | 3 | 4 |
| after using the toilet or changing diapers | 0 | 1 | 2 | 3 | 4 |
| for at least 20 seconds before rinsing them off | 0 | 1 | 2 | 3 | 4 |

| 12. I wash counter tops, cutting boards, dishes, and utensils with hot soapy water . . . | Never | | | | Always |
|---|---|---|---|---|---|
| before beginning food preparation | 0 | 1 | 2 | 3 | 4 |
| after handling raw meat | 0 | 1 | 2 | 3 | 4 |
| after I prepare each food item | 0 | 1 | 2 | 3 | 4 |

| 13. I clean fruits and vegetables by . . . | Never | | | | Always |
|---|---|---|---|---|---|
| scrubbing firm skinned items | 0 | 1 | 2 | 3 | 4 |
| rinsing tender skinned items and greens | 0 | 1 | 2 | 3 | 4 |

| 14. I keep raw meat, poultry, seafood, and their juices away from ready-to-eat foods. . . | Never | | | | Always |
|---|---|---|---|---|---|
| in the refrigerator | 0 | 1 | 2 | 3 | 4 |
| when using my cutting boards | 0 | 1 | 2 | 3 | 4 |
| when I prepare food | 0 | 1 | 2 | 3 | 4 |

| 15. I make sure that food is safe to eat by . . . | Never | | | | Always |
|---|---|---|---|---|---|
| checking the "sell by" and "use by" dates | 0 | 1 | 2 | 3 | 4 |
| observing the "sell by" and "use by" dates | 0 | 1 | 2 | 3 | 4 |
| throwing away leftovers after 3-4 days | 0 | 1 | 2 | 3 | 4 |

| 16. I make sure food is cooked properly by . . . | Never | | | | Always |
|---|---|---|---|---|---|
| using a food thermometer to measure the internal temperature | 0 | 1 | 2 | 3 | 4 |
| cooking ground beef, pork, veal, or lamb until it reaches 160° F | 0 | 1 | 2 | 3 | 4 |
| cooking chicken, turkey, or duck until it reaches 165° F | 0 | 1 | 2 | 3 | 4 |
| cooking eggs until the white and yolk are firm | 0 | 1 | 2 | 3 | 4 |
| bringing soups, sauces, and gravy to 165° F when reheating | 0 | 1 | 2 | 3 | 4 |

| 17. I make sure food is handled properly by . . . | Never | | | | Always |
|---|---|---|---|---|---|
| using a food thermometer to assure the refrigerator is below 41° F | 0 | 1 | 2 | 3 | 4 |
| chilling leftovers within 2 hours | 0 | 1 | 2 | 3 | 4 |
| refrigerating perishable foods as soon as I get them home from the store | 0 | 1 | 2 | 3 | 4 |
| defrosting foods using the refrigerator, microwave, and/or cold running water | 0 | 1 | 2 | 3 | 4 |

## Section III: Technology Usage

18. Which sources of information do you use in your county? **(circle ALL that apply)**

A. Public library
B. County Extension Office
C. County office building
D. Civic organization (Lyon's Club, Rotary, etc.)
E. City Hall
F. Senior Center
G. None
H. Other: _____

19. How do you like to learn new things? **(circle ALL that apply)**

A. Reading
B. Looking things up on the computer
C. Hands-on-activities
D. Instructor talking or reading to me
E. Videos

20. I use the following types of technology . . . **(circle ALL that apply)**

A. TV
B. VCR
C. DVD
D. CD player (audio)
E. Digital camera
F. Computer
G. Internet
H. Cell phone
I. Touch screen (gas pump/credit card reader)
J. ATM machine (banking)

21. What type of TV programming do you usually watch? **(circle ALL that apply)**

A. Morning news show
B. Mid-morning talk show
C. Mid-day local news
D. Afternoon talk shows, daytime drama, and/or game shows
E. Local evening news
F. National evening news
G. Evening game shows
H. Prime-time programming
I. Ten o'clock news
J. Late night talk shows

**22.** Which TV and radio stations do you usually watch or listen to?

| **TV** | **Radio** |
|---|---|
| _____ | _____ |
| _____ | _____ |

23. Are you an AARP member?

A. Yes → Have you visited the AARP website?
   A. Yes
   B. No
B. No

24. Do you own or have access to a computer?

A. Yes, I own a computer → I use the computer for: (circle all that apply)
   A. Entertainment
   B. Education
   C. Communication—email and letters
   D. Other _____
B. Yes, I have access to a computer
C. No, I do not have /use a computer

25. How often do you use a computer?

A. Everyday
B. Once a week
C. A few times a month
D. A few times a year
E. I do not use a computer

**---- SKIP QUESTIONS 26-31 IF YOU DO NOT USE A COMPUTER ----**

26. Where do you access the Internet? **(circle ALL that apply)**

A. At home
B. Away from home—library, friend's/neighbor's house, etc.
C. No Internet access

27. Have you participated in any Internet classes?

A. Yes
B. No

28. Please list several of your favorite Internet-sites.

_____ _____

_____ _____

29. What makes a web site easier to use when looking something up?

A. Larger font
B. Uncluttered appearance
C. Links to information highlighted in another color
D. Links that are clearly labeled
E. Other: _____

30. What things do you like about computer learning? **(circle ALL that apply)**

A. I like pictures (photos and drawings)
B. I like music and sounds
C. I like video
D. I like games that ask me questions
E. I like the control (I can navigate where to go and when to stop or start)
F. I like easy to print information

31. Which of the following would encourage you to use a computer more often? **(circle ALL that apply)**

A. Instruction or training on how to use a computer
B. Computer programs that are easy to understand and use
C. Free access to the Internet
D. Faster access to the Internet
E. Other: _____

## Section IV: Food Safety Attitudes Toward Proper Food Handling

**Directions:** Please answer each of the following questions by circling the number that best describes your opinion. Please read each question carefully, they may appear similar, but they do address different issues.

**PROPER FOOD HANDLING INCLUDES:**

- Scrubbing sturdy fruits/vegetables
- Thoroughly rinsing tender skinned fruits/vegetables and leafy greens
- Washing cutting boards, knives, and preparation surfaces with soap and water to ensure no food particles are left behind
- Storing leftovers in portion-sized containers and refrigerating within two hours

32. I feel that safely preparing food is… (circle the corresponding number)

| | | | | | | |
|---|---|---|---|---|---|---|
| Bad | 1 | 2 | 3 | 4 | 5 | Good |
| Worthless | 1 | 2 | 3 | 4 | 5 | Valuable |
| Difficult | 1 | 2 | 3 | 4 | 5 | Easy |
| Unpleasant | 1 | 2 | 3 | 4 | 5 | Pleasant |
| Unimportant | 1 | 2 | 3 | 4 | 5 | Important |

33. Properly handling foods _____.

| | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|
| takes too much time | 1 | 2 | 3 | 4 | 5 |
| is difficult without easy to clean cutting boards | 1 | 2 | 3 | 4 | 5 |
| is difficult because of the cost of necessary supplies (extra cutting boards, knives, cleaning supplies, etc.) | 1 | 2 | 3 | 4 | 5 |
| is difficult without enough space | 1 | 2 | 3 | 4 | 5 |
| is important to my spouse | 1 | 2 | 3 | 4 | 5 |
| is important to my family | 1 | 2 | 3 | 4 | 5 |
| is important to my friends | 1 | 2 | 3 | 4 | 5 |
| is important to my healthcare professional | 1 | 2 | 3 | 4 | 5 |

34. Please indicate how often the following statements **AFFECT** proper food handling for you. **(circle the corresponding number).**

| | Rarely | | | | Frequently |
|---|---|---|---|---|---|
| takes too much time | 1 | 2 | 3 | 4 | 5 |
| is not convenient | 1 | 2 | 3 | 4 | 5 |
| I properly handle foods to stay healthy | 1 | 2 | 3 | 4 | 5 |
| not having easy to clean cutting boards makes it difficult to properly handle foods | 1 | 2 | 3 | 4 | 5 |
| the cost of having extra cutting boards, knives, cleaning supplies, etc prevents me from properly handling foods | 1 | 2 | 3 | 4 | 5 |
| not having enough space prevents me from properly handling foods | 1 | 2 | 3 | 4 | 5 |
| I value my spouse's opinion when handling foods | 1 | 2 | 3 | 4 | 5 |
| I value my family's' opinion when handling foods | 1 | 2 | 3 | 4 | 5 |
| I value my friends' opinions when handling foods | 1 | 2 | 3 | 4 | 5 |
| I value my healthcare professionals' opinion when handling foods | 1 | 2 | 3 | 4 | 5 |

35. How much do you **AGREE** with the following statements?
**(circle the corresponding number)**

| | Agree | | | | Disagree |
|---|---|---|---|---|---|
| most people who are important to me think that I should properly handle foods | 1 | 2 | 3 | 4 | 5 |
| I plan to properly handle foods | 1 | 2 | 3 | 4 | 5 |
| It is expected that I will properly handle foods | 1 | 2 | 3 | 4 | 5 |
| the people in my life whose opinions I value would approve of my food handling | 1 | 2 | 3 | 4 | 5 |
| it is my choice whether I properly handle food | 1 | 2 | 3 | 4 | 5 |
| I will try to properly handle foods | 1 | 2 | 3 | 4 | 5 |
| I am able to properly handle foods | 1 | 2 | 3 | 4 | 5 |

## Section V: Eating Out

36. Do you worry about food safety when eating out?

A. Yes
B. No
C. Only sometimes

37. Thinking about the last two weeks, how often did you eat out?

| | 12 or more times weekly | 9-11 times weekly | 5-8 times weekly | 3-5 times weekly | 1-2 times weekly | None |
|---|---|---|---|---|---|---|
| at restaurants | | | | | | |
| at friend's home | | | | | | |
| at community based meal site | | | | | | |
| other: | | | | | | |

38. What meal do you usually eat out? **(circle ALL that apply)**

A. Breakfast
B. Lunch
C. Dinner

39. Rate your concern regarding food safety in the following food preparation areas.

| | No concern | | | | Significant concern |
|---|---|---|---|---|---|
| friend's kitchen | 0 | 1 | 2 | 3 | 4 |
| restaurant's kitchen | 0 | 1 | 2 | 3 | 4 |
| community based meal site | 0 | 1 | 2 | 3 | 4 |

40. Rate your concern about food safety principles when eating out.

| | No concern | | | | Significant concern |
|---|---|---|---|---|---|
| servers and cooks not washing their hands | 0 | 1 | 2 | 3 | 4 |
| general cleanliness of the staff | 0 | 1 | 2 | 3 | 4 |
| workers that are ill | 0 | 1 | 2 | 3 | 4 |
| not cooking hamburgers to proper temperature | 0 | 1 | 2 | 3 | 4 |
| not cooking eggs until yolks and whites firm | 0 | 1 | 2 | 3 | 4 |
| overall cleanliness of the operation | 0 | 1 | 2 | 3 | 4 |
| not washing produce thoroughly | 0 | 1 | 2 | 3 | 4 |
| not washing hands between raw and cooked foods | 0 | 1 | 2 | 3 | 4 |
| not holding cold foods at proper temperatures | 0 | 1 | 2 | 3 | 4 |
| not holding hot foods at proper temperatures | 0 | 1 | 2 | 3 | 4 |

41. Do you have any other concerns about food safety while eating out?

_____

_____

_____

## Section VI: Food Frequency

42. Thinking of only the last 4 months, please mark how often the following foods have been consumed. at home or when eating out

| | Everyday | 2-3 times weekly | Once a week | 2-3 times monthly | Once a month | Never |
|---|---|---|---|---|---|---|
| Eggs | | | | | | |
| Beef (steak or roast) | | | | | | |
| Ground beef | | | | | | |
| Venison | | | | | | |
| Ground venison | | | | | | |
| Poultry (whole or pieces) | | | | | | |
| Ground chicken or turkey | | | | | | |
| Other fowl | | | | | | |
| Pork (chops or roast) | | | | | | |
| Sausage | | | | | | |
| Fish | | | | | | |
| Sushi | | | | | | |
| Hot dogs (un-heated) | | | | | | |
| Hot dogs (heated) | | | | | | |
| Lunchmeat | | | | | | |
| Sprouts | | | | | | |
| Unpasteurized milk | | | | | | |
| Water from private well | | | | | | |
| Leftovers | | | | | | |

43. Thinking of the last 4 months, please mark how often you prepared the following foods at home..

| | Everyday | 2-3 times weekly | Once a week | 2-3 times monthly | Once a month | Never |
|---|---|---|---|---|---|---|
| soup heated from a can or package | | | | | | |
| frozen meal | | | | | | |
| soup or beans from scratch | | | | | | |
| a roast cooked in the oven | | | | | | |
| a casserole from scratch | | | | | | |
| whole or partial chicken | | | | | | |
| a hamburger (from raw meat) | | | | | | |
| cookies, brownies, or cake | | | | | | |

## Section VII: Demographic Information

**Directions**: Please circle the letter that best represents you.

44. What is your gender?

A. Male
B. Female

45. How would you rate your current health?

A. Excellent
B. Very good
C. Good
D. Fair
E. Poor

46. How much formal education have you received?

A. Graduated 8th grade
B. Graduated high school
C. Some college education
D. Received a college degree
E. Completed an advanced degree

47. Have you had any food safety education within the last five years?

A. Yes
B. No

48. For how many people do you normally cook meals?

A. 1—just myself
B. 2
C. 3
D. 4 or more

49. What is your primary ethnicity?

A. White
B. Hispanic/Latino
C. Black
D. Asian
E. American Indian
F. Bi-racial

50. Which language do you primarily speak?

A. English
B. Spanish
C. Bilingual
D. Other: _____

51. Which language do you primarily read?

A. English
B. Spanish
C. Bilingual
D. Other: _____

52. Which is your preferred language for printed materials?

A. English
B. Spanish
C. Bilingual
D. Other: _____

53. What is your birth date?

_____/_____/19_____

Thank you for your time in completing the questionnaire.

For further information contact:

Department of Human Nutrition
206 Justin Hall
Manhattan, KS 66506

# Appendix E - **Format Thank You Letter**

Date

Address
Address
Address

Dear (name):

Thank you for allowing us to visit (site) on (date), and to administer the Food Safety Education questionnaire. It was a pleasure meeting (names), and the group; what a wonderful bunch of people. We collected (number) usable booklets, and will add that data to our study. Participants completing the questionnaire received refrigerator thermometers, and I hope that the thermometers are put to good use. As we complete the next phase of our study, I'd be happy to share our results, and will keep in touch with you.

Again, many heartfelt thanks.

Sincerely,

Valentina Remig, PhD, RD
Assistant Professor

Tracy Sabo, RD
Graduate Student

Appendix F - **Table 10—Food Safety Knowledge Replies of Mature Kansans**

## Table 10. Food Safety Knowledge Replies of Mature Kansans

| | *n Correct* | *%* |
|---|---|---|
| *Foodborne illness symptoms:* | | |
| **Which are symptoms of foodborne illness?** | | |
| diarrhea | 126 | 90.0 |
| vomiting | 117 | 83.6 |
| dizziness | 72 | 51.4 |
| nausea | 111 | 79.3 |
| fever | 64 | 45.7 |
| headaches | 70 | 50.0 |
| *Handwashing:* | | |
| **When should you wash your hands?** | | |
| before eating | 105 | 75.0 |
| before handling foods | 131 | 93.6 |
| after playing with pets | 114 | 81.4 |
| after handling raw meat | 117 | 83.6 |
| after using the toilet or changing diapers | 117 | 83.6 |
| if my hands look dirty | 95 | 67.9 |
| **Necessary supplies for proper hand washing:** | | |
| cold water* | 129 | 92.1 |
| hand sanitizer* | 91 | 65.0 |
| soap | 122 | 87.1 |
| 20 seconds of scrubbing hands | 98 | 70.0 |
| warm water | 108 | 77.1 |
| 15 seconds of scrubbing hands* | 107 | 76.4 |
| **How to properly dry your hands:** | | |
| with a dish or hand towel* | 89 | 63.6 |
| with a blow dryer | 67 | 47.9 |
| with a clean paper towel | 118 | 84.3 |
| on my apron* | 134 | 95.7 |
| by shaking my hands | 8 | 5.7 |
| on my clothing* | 134 | 95.7 |
| *Food Preparation:* | | |
| **Correct food temperatures:** | | |
| Cold foods should be held below41°F | 115 | 82.1 |
| Hot foods should be held above 140°F | 120 | 85.7 |
| Leftovers should be reheated to 160°F* | 115 | 82.1 |
| Ground beef should be cooked to 150°F* | 39 | 27.9 |
| Chicken should be cooked to 165°F | 86 | 61.4 |
| Casseroles should be cooked to 170°F* | 138 | 98.6 |

*-- continued to next page --*

*Indicates an incorrect food safety practice

n=140; due to non-respondents totals may not equal 140 or 100%

## Food Safety Knowledge Replies of Mature Adults (continued)

| | *n Correct* | *%* |
|---|---|---|
| **How to determine if food is properly cooked?** | | |
| look at it to make sure it is the right color* | 117 | 83.6 |
| touch it to see that it is hot enough* | 134 | 95.7 |
| make sure it has been cooking for the correct amount of time* | 53 | 37.9 |
| use a food thermometer | 113 | 80.7 |
| look at the center of the food not just the surface of the food* | 65 | 46.4 |
| taste it to see if it tastes right* | 127 | 90.7 |
| **Proper defrosting of frozen foods:** | | |
| at room temperature* | 115 | 82.1 |
| in the refrigerator | 120 | 85.7 |
| in cold/hot standing water & cook immediately* | 115 | 82.1 |
| under cold running water | 39 | 27.9 |
| in the microwave and cook immediately | 86 | 61.4 |
| in a cold part of the house* | 138 | 98.6 |
| *Food Handling:* | | |
| **How to wash fresh fruits and vegetables:** | | |
| wipe them gently with a clean paper towel* | 118 | 84.3 |
| rinse them under running water | 120 | 85.7 |
| scrub firm skinned fruits and vegetables with a brush under running water | 102 | 72.9 |
| use a fruit and vegetable cleaning solution* | 102 | 72.9 |
| use a mild bleach* | 125 | 89.3 |
| scrub melons with a mild soap and water | 34 | 24.3 |
| **How to prevent cross-contamination:** | | |
| wash cutting boards with hot soapy water after each food item | 125 | 89.3 |
| dry cutting boards thoroughly after each use* | 72 | 51.4 |
| use a sponge to thoroughly clean countertops* | 94 | 67.1 |
| keep raw meat above fruits and vegetables in the refrigerator* | 116 | 82.9 |
| do not place cooked meat on a plate that held raw meat | 106 | 75.7 |
| only clean surfaces when they look dirty | 131 | 93.6 |
| **Proper ways to handle leftovers:** | | |
| leave leftovers out if they have been thoroughly cooked* | 135 | 96.4 |
| always refrigerate leftovers from a restaurant within 4 hours* | 92 | 65.7 |
| store leftovers in big containers* | 131 | 93.6 |
| use a thermometer to ensure refrigerator is colder than 41°F | 67 | 47.9 |
| always eat or discard leftovers within one week* | 63 | 45.0 |
| refrigerate leftovers within two hours of food | 113 | 80.7 |

*Indicates an incorrect food safety practice

n=140; due to non-respondents totals may not equal 140 or 100%